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**and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT**

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## ELECTRIC PROPULSION OF SHIPS.

The installation of motor drive upon the collier *Jupiter* two years ago and the subsequent remarkably successful operation of the equipment demonstrated not only the feasibility but the great advantages of electric propulsion. The *Jupiter*, however, does not represent the type of vessel in which these advantages will reach their greatest magnitude. It is therefore pleasing to note that the Navy officials have finally been won over sufficiently to sign a contract for electric propulsion of a battleship, and the *California* has been selected for a trial of this equipment.

Among modern methods of drive, the electric equipment has two chief competitors, the direct-connected steam turbine and the geared steam turbine. Superficially the former seems to have the advantages of simplicity and lower first cost. Practically this is not true, since a multiplicity of turbine units required for reversing, etc., adds not only to the expense but to the weight and space required. The electric equipment proves more favorable from these standpoints. It is, besides, more efficient, the losses in the two conversions of energy involved being more than balanced by the fact that neither turbine nor propeller can run at the most favorable speed when they are directly connected. In flexibility the electrical equipment is far in the lead. It can not only vary the speed and direction of rotation of the propellers simply and with slight additional control apparatus, but it can maintain good operating efficiency under these different conditions of service.

The interposition of gearing between turbine and propeller shafts permits a better selection of their respective speeds and thus improves the efficiency attainable. It leaves the speed ratio fixed, however, and hence efficient operation is confined to a single speed. This condition may be suited to a freighter, and this type of vessel may achieve as low a steam consumption with a geared turbine as with electric motor drive. The condition does not fit operating requirements of a war vessel, which normally cruises at moderate speed, but must be equipped for high-speed service during hostilities. The latter conditions are met pre-eminently by electrical drive.

These points were very lucidly brought out by Mr. W. L. R. Emmet in his recent talk before the Western Society of Engineers, as reported in the last issue. Mr. Emmet made no comparison between the steam turbine and the internal-combustion engine as a prime mover, and it may be that the latter, combined with electric drive, will take its place at some future date among the

preferable forms of drive. The present development of the internal-combustion engine with respect to large blocks of power does not, however, make it an active competitor as regards ships of large size.

The economy of the electrical equipment was strikingly brought out by the statement that a saving of $150,000 a year could be effected in the coal bill of the *Lusitania* if that vessel were equipped with electric drive. Then there is the advantage of locating the prime mover in any favorable location, regardless of the propeller shaft. Requirements of space, weight and initial investment are less for electrical equipment. These facts, combined with simplicity of control and simplicity and infrequency of repairs, makes it apparent that electric propulsion of ships faces an immense future development, not only in battleships, for which it is peculiarly fitted, but also in large vessels of the merchant marine.

## PHYSICAL EXAMINATION FOR ELECTRICAL WORK.

The necessity for physical examinations before undertaking certain lines of work has long been recognized. Thus it is necessary to eliminate from the candidates for locomotive engineers and other train operatives those who have defective color vision. A definite standard of general physical fitness is set for recruits in the army and navy. In some cases the necessity for meeting such tests is based upon the protection of patrons or of the general public, in other cases upon the safety of the worker himself, and in still others upon financial considerations connected with liability for damages or for pensions arising from injuries due to physical unfitness. The two latter considerations have become more impelling under the type of workmen's compensation act which has recently undergone legal enactment in a number of the states. There is also the consideration that the quality of the work done, other things being equal, will depend upon the physical as well as the mental fitness of the worker.

Little attention has been given to the desirability of physical examinations for electrical workers, although the matter was brought up at a recent meeting of the Association of Iron and Steel Electrical Engineers in connection with steel-mill work.

We have before called attention in these columns to the excellent results secured from preliminary tests of telephone operators. In this case the question is more of a psychological than a physical one, as the question of fitness for the work depends upon temperament, speed of reaction, etc., and the element of danger scarcely enters. In the case of linemen and station attendants who must handle high voltages the item of good heart action becomes of importance. Persons subject to heart disease are in far greater danger from electric shock than are normal persons. Some such disorder is probably responsible for the occasional cases of deaths from shock at moderate voltages. It is probably true that a majority of deaths from electric shock could be prevented by proper attempts at resuscitation promptly made. Nevertheless it would be preferable to recognize cases of weak heart beforehand and place such individuals in positions where there would be no probability of contact with conductors at even moderate voltages.

Similarly, epileptics should not be permitted to work in rooms where there is moving machinery or high-voltage conductors. Men subject to vertigo are not suited to pole-line work or other occupations where there is especial danger from a fall. And so the list might be continued.

With respect to communicable diseases, examinations should be made wherever large bodies of workers are brought together for the benefit of both the subject and his associates. The subject may often be cured if treatment is given in the preliminary stages of disease, and his fellow workers have the right to protection from exposure. Tuberculosis, trachoma, syphilis and other common diseases may easily pass unnoticed without special examinations, and sometimes large numbers of workers are infected before the source of contamination is located. Initial examinations would prevent such occurrences. Trachoma seems more common in shops employing large numbers of immigrants, but other communicable diseases are equally common among Americans.

Prevention is always better than cure, whether it be applied to disease or to accident. "Safety First" is an excellent motto, and its full application involves placing every employee in a position for which he is fitted, physically as well as mentally. Proper attention to this feature of selection pays for itself in better service or output, fewer accidents to persons, less damage to property and lower payments for compensation. In short, it pays from both the humanitarian and the financial standpoints.

## INDUSTRIAL ELECTRIC HEATING.

The term "electric heating" is likely to bring to mind the coffee percolator, the flat iron, the toaster, or possibly the glue pot. Most of us think of its application in small units. In those parts of the West where coal is scarce and water power plentiful, the idea is associated with electric cook stoves and radiators. In industrial applications, where cost is usually the prime consideration and convenience is secondary, probably few of us realize the advances which electric heaters have been making. Nevertheless instances of such applications are not wanting, as is evidenced by the enameling oven installed in Toledo and by the electric baking oven at Toronto, recently described in our pages. Similar applications of electric power have reached proportions such that there are enough specialists in this line to organize an association and as a result we have the Industrial Electric Heating Association, with Mr. A. K. Young as president and Mr. Homer J. Kunz as secretary.

We trust the Industrial Electric Heating Association will be successful in developing a wider use of electric heating.

## REGULATION OF SECURITY ISSUES.

Under state regulation of public utilities, it has become common to require approval of new issues of the securities of such corporations by the state utility commission before such securities can be legally issued. Such approval usually involves an investigation of the purposes for which the proceeds of such securities are to be applied and a subsequent report of the actual expenditures made for such purposes. It also limits the price at which securities are sold. Obviously this affords a certain amount of protection to investors and in certain cases it may also aid the utility corporation to obtain a market for the securities.

Objections have been raised in some quarters to this control of security issues by government officials on the ground that such approval by constituted authority amounts to a guarantee on the part of the Government that such securities represent a sound investment, and that any future action by the Government whose result would be a lessening of the market value of the securities would be inhibited. Even though the Government would not be legally bound in such a case, it is claimed that a moral obligation exists to maintain as far as possible the value of such securities unimpaired.

This point does not seem to us to be well taken. Approval of an issue of securities by a utilities commission merely indicates that the securities in question are being issued in conformity with the law and that the purposes for which the funds are to be applied is one which is authorized by the public utilities act. The future value of any issue of stock will depend upon the total amount of securities outstanding and upon the value of the property owned by the corporation, as well as other influences, and these are usually matters over which the utilities commission has not had control. Moreover, official approval is an indication not of value, but rather of the legality of the issue. Responsibility of a commission, or of the state itself in the matter, is no greater, or indeed not as great, as that of an investment banker who has investigated a particular issue of securities and recommended them to his clients. Such a recommendation indicates that the banker has made an investigation, and that in his judgment and that of his legal adviser, the investment is a good one. No one would think of holding such a banker financially responsible in case of the slump of the given securities, even though in a particular case, for the sake of his reputation, of the good will of his customers, or the future of his business, some banker might consider it good policy to pocket the losses. Only in case of wilful misrepresentation or intent to defraud would the banker be held liable for his clients' losses.

Approval of an issue of securities by a government commission may make a separate inquiry into the validity or legality of an issue superfluous, but it is in no sense a guarantee of the value of the securities. It may assure the existence of physical property corresponding to the capital in question, but the future value of such property is an entirely separate matter. No doubt attempts have been made in the past by promoters or dealers in securities to represent that commission approval carries some guarantee to the investor, and such attempts by the unscrupulous may be expected in the future, but such representations are merely efforts to mislead the uninformed and cannot be regarded as placing any legal or moral obligation upon the Government to maintain or assist in maintaining the value of such securities. The proposal that capital stock shall be issued without any face value might assist in removing complications and misunderstandings in such matters.

## ELECTROPLATING WITH COBALT.

Probably no other paper presented at the spring meeting of the American Electrochemical Society, which was reported in the last issue, is of such general interest as the one by Messrs. Kalmus, Harper and Savell, dealing with the electrodeposition of cobalt. This is on account of the facts brought out indicating that cobalt may well replace nickel in a great many applications where nickel plating is now used. For the past 20 years nickel plating has been widely utilized to protect other metals, such as iron, from oxidation, and to give a finished surface which would take a polish, have an attractive appearance, and not be easily corroded. The performance of nickel has not, however, been ideal. Peeling of the nickel has not been uncommon, and oxidation is not unknown.

Cobalt is in appearance somewhat similar to nickel, but it has a bluish cast. Its specific gravity is about 8.8, or nearly the same as nickel, but its hardness is greater than that of either nickel or iron. This is a very desirable quality in a plating metal. The electrical conductivity is slightly greater than that of nickel. As far as its physical properties are concerned, cobalt would no doubt be satisfactory as a substitute for nickel, and would have some advantages over the latter. Its wide commercial use will depend upon the cost of the metal and of the plating operation, the rapidity with which the work can be done, and the adherence of the deposit. The authors of the paper provide some interesting information on these points.

Where suitable plating solutions are used, the deposits (on a variety of metals) are found to be firm, adherent, hard and uniform, and can be deposited at a much more rapid rate than is feasible with nickel. Equal protection to the plated surface is afforded by a much thinner deposit of cobalt than of nickel. This not only offsets a higher unit price for the metal, but enables a larger daily output of work from a given plant. The power consumption is also less for cobalt.

If these results can be attained in every-day commercial operation, as they have in the laboratory tests at Queen's University, there is a bright prospect for cobalt displacing nickel in a great deal of plating work. From almost every point of view cobalt appears superior.

## Program of Oklahoma Association Meeting.

The fourth annual convention of the Gas, Electric and Street Railway Association of Oklahoma will be held at the Lee Huckins Hotel, Oklahoma City, May 12 to 14. At the session on Wednesday afternoon there will be an address of welcome by Mayor Ed Overholser, the address of President George W. Knox, a paper by A. L. Mullergren on "The Modern Generating Station," and a paper by J. J. Johnson on "The So-Called Jitney Service."

There will be two sessions on Thursday at which the following papers will be presented: "Utility Appraisals under Order No. 774," by George B. Saunders; "Analysis of Rates of Gas and Electric Utilities in Oklahoma," by R. W. Stinson and Homer Livergood; "Relative Values of Coal, Oil and Gas as Fuels for the Production of Electric Power," by E. E. Hunter; "Supply and Demand of Natural Gas in Oklahoma," by W. J. Dibbens.

On Friday there will be a session in the morning, with annual reports, general business, election of officers, question box and the two following papers: "Care and Sale of Supplies and Current-Consuming Devices by Public Service Companies," by Galen Crow; "Public Utilities—Their Customers—and the Public," by Noel R. Gascho.

On Wednesday evening there will be a barbecue at Briarwood Park; on Thursday evening a banquet, and on Friday evening a Jovian rejuvenation. On Friday afternoon there will be a sight-seeing trip.

## Cincinnati Electrical League Formed.

The Cincinnati Electrical League, which has been organized by J. S. Rickard, of New York, with the local branch of the Jovian Order as a nucleus, held its first meeting last week, with an attendance of 75 electrical men. President W. W. Freeman, of the Union Gas & Electric Company, acted as toastmaster, lending the weight of his influence to the project of forming a strong association of electrical men in all branches of the industry.

## Annual Meeting of Fire Protection Association.

The nineteenth annual meeting of the National Fire Protection Association will be held at the Hotel Astor, New York City, May 11 to 13. Among the reports to be presented are one from the Electrical Committee of which F. E. Cabot is chairman, and one from the Committee on Signaling Systems, of which Ralph Sweetland is chairman.

## Louisville Jovians to Organize Permanent Electrical Exhibit.

Louisville Jovians are behind a movement which is being organized with the object of erecting and equipping a permanent electrical display building as a part of the plant of the Kentucky State Fair. It is proposed to raise a fund of $10,000 for the purpose and various electrical and electric supply interests in the state, or represented in the state, will be asked to contribute to the fund and to contribute apparatus. Robert Montgomery is directing organization of the campaign, and it is the hope of the Jovians associated with him to have the building completed and the display installed by the time the fair opens in September.

A similar plan was discussed in some detail a year ago, but the time appeared too short to get anywhere by September, and the project was allowed to sleep through the winter. Now, however, it is being revived with every indication that it will get results. The plan proposed that the displays will illustrate every use to which electricity can be and is being put in lighting, heating and when used for power.

## Erie Jovians Plan Big Rejuvenation.

A rejuvenation which is looked forward to by the Jovians of Erie, Pa., as one which will draw hundreds of visitors from New Castle, Pittsburgh, Ellwood City, Cleveland, Youngstown, Union City, Meadville, Warren and other nearby places, is being planned to take place during the middle of June.

Visitors will bring their own classes of candidates to be initiated, and after the ceremonies, in which Mayor Stern and other Erie city officials who are Jovians will take part, the crowd will go for outing, games and fish fry to some selected place on Lake Erie. The above plan was broached at a dinner given recently by the Erie Jovians at the Reed House, with W. H. Wilson, Tribune, presiding.

It was also decided at the meeting that all stores controlled by Jovians will close on Saturday afternoons at 12:30 o'clock from June 1 to October 1. This will be done to give the employees and the storekeepers the half-holiday customary in summer. The commercial bodies of the city were notified of the movement and will also co-operate.

One of the most important meetings of the Erie Jovians, was held Monday evening, April 26, in the Reed House, when E. C. Corrigan, vice-president of the National Metal Molding Company, Pittsburgh, spoke on "Concentric Wiring."

## Illuminating Engineering Society Election.

Ballots for the annual election of officers of the Illuminating Engineering Society have been mailed to the members. The following ticket has been nominated:

President, C. P. Steinmetz; vice-presidents, Clarence L. Law, J. L. Minick; general secretary, Alten S. Miller; treasurer, L. B. Marks; directors, W. A. Durgin, M. Luckiesh, J. Arnold Norcross.

Chicago Section: Chairman, E. W. Lloyd; secretary, O. L. Johnson; managers, A. O. Dicker, H. M Frantz, C. A. Luther, A. H. Meyer, F. A. Rogers.

New York Section: Chairman, D. McFarlan Moore; secretary, Norman D. Macdonald; managers, Thomas M. Ambler, L. H. Graves, W. F. Little, E. R. Treverton, Herbert Whiting.

Philadelphia Section: Chairman, George S. Crampton; secretary, L. B. Eichengreen; managers, G. S. Barrows, Douglas Burnett, C. E. Clewell, R. B. Ely, C. E. Ferree.

New England Section: Chairman, Louis Bell; secretary, S. C. Rogers; managers, J. W. Cowles, W. B. Lancaster, G. P. Smith, Jr., H. F. Wallace, R. C. Ware.

Pittsburgh Section: Chairman, Lewis J. Kiefer; secretary, R. H. Skinner; managers, Henry Harris, H. S. Hower, Harold Kirschberg, H. H. Magdsick, G. W. Roosa.

A number of constitutional amendments have been proposed. The principal change of these proposals is the one which, if adopted, will divide the present members into two grades—associate members paying annual dues of $5, and members paying $10. The rights and privileges of both classes are to be identical except that only members shall be eligible as officers of the society.

## General Secretary for Manufacturers' Association.

A committee of the Associated Manufacturers of Electrical Supplies has been appointed by President Sheppard to consider and recommend to the Board of Governors a general secretary for the association. The committee consists of D. C. Durland, Sprague Electric Works, New York; W. A. Connor, Standard Underground Cable Company, Perth Amboy, N. J., and J. E. Way, R. Thomas & Sons Company, New York, N. Y.

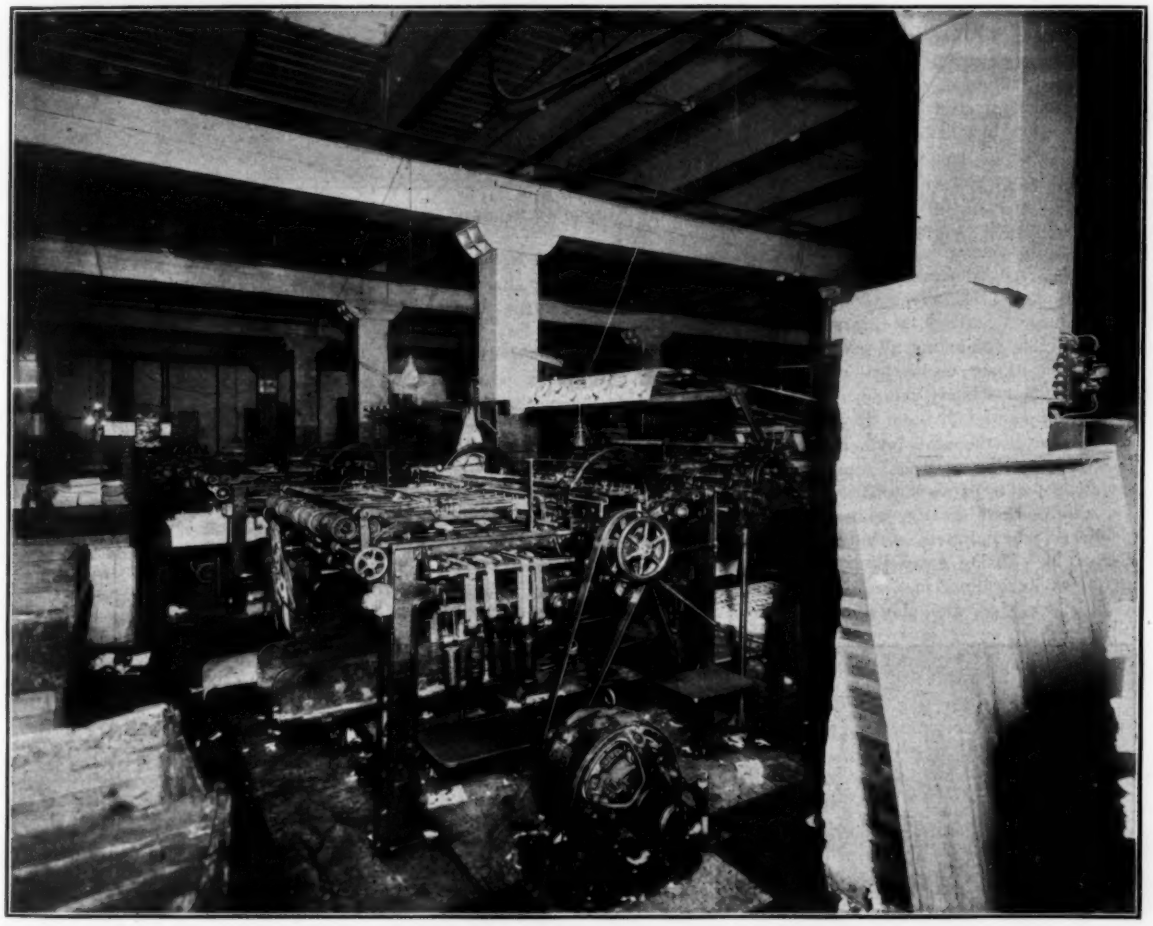
At the present time there is practically no hydroelectric power development in China. Such electrical plants as have been installed are driven almost altogether by steam. The immense delta plains of the Yangtze and Yellow Rivers, are not, in a general sense, suitable for hydroelectric plants, but in Fukien, Yunnan and parts of Shantung provinces, water-power stations may ultimately be installed.

# Electricity in Printing Plants

**The exacting requirements of printing machinery such as wide range of speed, frequent and quick starting and stopping and continuous service make electric drive with central-station service extremely desirable. Figures are given in this article on the economies and other advantages of motor drive with data on a typical installation.**

In no other industrial field requiring motive power has electric drive become more deservedly popular than in the printing trade. Printers were the first to appreciate the advantages of electricity, both for lighting and power, and there are few if any branches of industry in which greater advantages can be shown. Today the standards set for high-grade work, combined with rapid production, are only attainable where electric energy is used.

In a comprehensive paper dealing with the use of electricity in the printing trade presented recently by Frank Broadbent before the (British) Association of Engineers-in-charge, several instances are cited showing the marked advantages and economies of electric motor drive which may be of value to central-station power engineers. Owing to the special character of the work electric driving offers exceptional advantages, for not only is it far more economical than mechanical driving, but it is cleaner, it produces better work, and also increases the output per machine. Generally speaking, there are a number of machines, each taking a small power per square foot of space occupied. The space occupied includes not only the actual ground space covered by the machine frame, but also the necessary gangways all around it. Take, for instance, a typical machine room of 16,000 square feet in which are located 28 machines. The maximum power-demand of the machine, exclusive of any shafting, would not exceed 100 horsepower, or one horsepower per 160 square feet of area, while the average horsepower would be about 50. If mechanical driving were adopted, there would be required about 450 feet of shafting, with its bearings, pulleys, and main belting; also 28 countershafts, each with cone pulley, fast and loose pulley, and two belts. It is a little difficult to actually estimate the power which would be required to drive all the shafting and belting, as the tests taken in various plants vary considerably. A figure which is frequently assumed is one horsepower per 10 feet of 2.5-inch shafting, running at 150 revolutions per minute. This would give about 45 horsepower for the main shafting alone. There is no doubt that with self-oiling bearings and the shafts properly alined, this figure might be reduced by half. We should have, however, in addition to the main shafting, the cone pulleys, and belts already referred to, which would take about as much power as the main shafting, so that not less than 45 horsepower could be figured as a standing loss of power on the installation during the whole of the



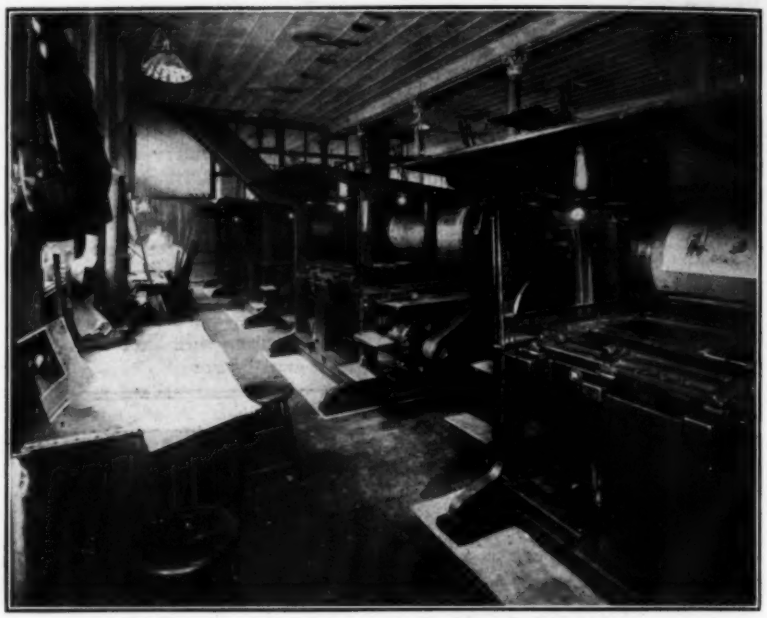
Group of Flat-Bed Presses Driven by Individual Motors.

working hours. Taking the maximum demand of the machines as 100, there would be required an engine of not less than 150 horsepower, the average load being 100 horsepower, made up of the 50-horsepower line-shaft losses and 50 horsepower usefully employed in the machines. This gives a transmission loss of 50 per cent, which may be taken to represent the average conditions. Assuming the cost per horsepower generated to be one cent per hour, and the working hours 2,500 per annum, there would be a loss of 125,000 horsepower-hours per annum, representing approximately $1,300 per annum, which, at 5 per cent, represents the interest on a capital outlay of $26,000.

In another plant the cost of gas both for power and lighting was $7,000 per annum. After electrification, notwithstanding the addition of several new machines, the cost for electricity was $4,000. The horsepower installed was about 200.

It must not, of course, be assumed that all that is necessary in order to effect these economies is to turn out a steam or gas engine, and put in a motor of equivalent power, for this would not eliminate the great losses in transmission which are referred to above. The advantages named are only to be obtained by entirely, or almost entirely, eliminating all intermediate power-absorbing media between the motor and the machine; in other words, by the adoption of individual driving.

In addition to the economy, effect of individual driving must be considered from other points of view. In the first place, all overhead shafting and belting is abolished which improves the lighting and also, by clearing away the obstruction caused by belting, makes for more efficient supervision, and also for cleanliness and better work, as overhead shafts and belts are continually throwing down fine dust on the machines and printed matter.



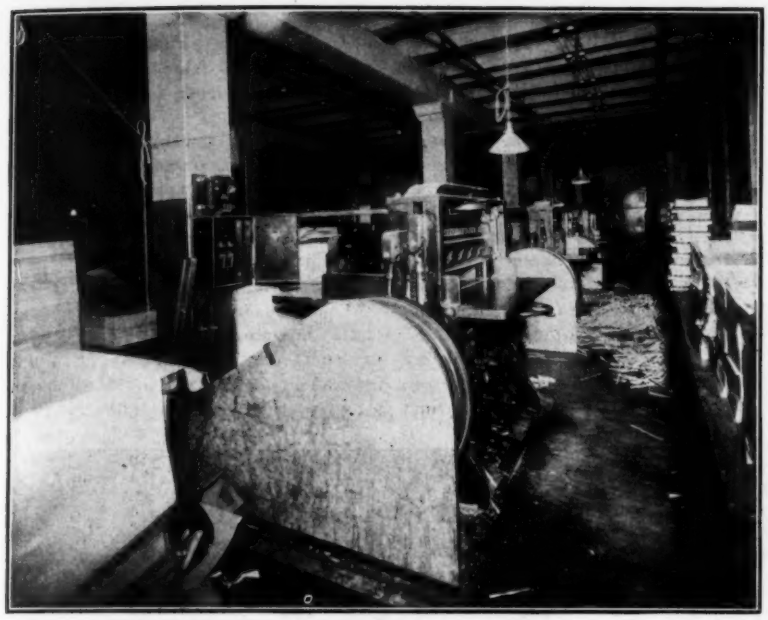
Group of Cylinder Presses Driven by Built-in Motors.

Another important factor to be considered is the improvement in the quality of the work due to the steadiness of the drive. When a machine is driven through various stages of shafting and belting the variation in speed of the machine is very much greater than that of the prime mover, and this variation has a marked effect on the quality of the work produced.

Still another and most important consideration, one which in some offices far outweighs even the cost of power, is the increased output which follows the change from mechanical to individual motor driving. The increased output comes about in this way. When driving by a three or four-step cone pulley, the machine is limited to three or four speeds, the speed being governed by the character of the job. As a rule the speed given by any step of the cone pulley, except the top speed, is lower than the maximum at which the job could be run off. For instance, if a job could be run at 1,300 impressions per hour, and the two nearest speeds given by the cones are 1,200 and 1,400 impressions per hour, the lower speed would have to be used, meaning a loss of 100 copies an hour. When individual driving is adopted a speed regulator can be provided giving 20 or more speeds between the maximum and minimum required, so that if the range is 50 per cent the machine speed can be brought up in increments of about 2.5 per cent. This advantage is not a theoretical one; it is borne out by the experience of practically every printing office in which individual electrical driving has been adopted, and printers who smile the smile of the skeptical when this advantage is pointed out to them as an inducement to electrify their plants, and who persist that they do not want more than three or four speeds, as these have always been sufficient for them in the past, are generally forced to admit afterwards that the fine speed control which is possible by electric driving has proved of inestimable advantage to them. The increased output may be anything between 10 per cent and 25 per cent, depending on the class of work done.

Job Presses Driven by Motors on Pedestals.

Manufacturers, generally speaking, endeavor to reduce the initial cost of an in-



Group of Motor-Driven Sheridan Paper Cutters. Driving Mechanism Inclosed.

stallation to a minimum, as this is the one item they can be certain about, whereas, the advantages from the point of view of economy and increased output are to them very problematical. In dealing with new establishments, the estimated cost of engines, shafting, belting, etc., can be set off against the estimated cost of the electrical installation, and the argument for individual driving is thereby very much strengthened.

In deciding upon the field winding of motors for driving printing machinery, the circumstances of the drive must be considered. A plain shunt motor is most suitable where it is desired to drive groups of machinery by means of shafts and belting, and in all cases where constant speed is required. For driving machines direct through spur or chain gearing, the motor should be compound wound so as to give a larger starting torque. To overcome the initial torque of the driven machine there are an endless variety of combinations between shunt and series windings which can be arranged, and it should be borne in mind that the greater the percentage of series turns, the larger will be the starting torque, whereas constancy of speed is more and more sacrificed as the series field is increased.

A good practice has been to allow 15 per cent of series winding, as being the most satisfactory winding for a motor driving a reciprocating printing machine, but sometimes this percentage leads to complaints of excessive speed on light loads, so perhaps an 8 per cent or 10 per cent allowance is more advisable.

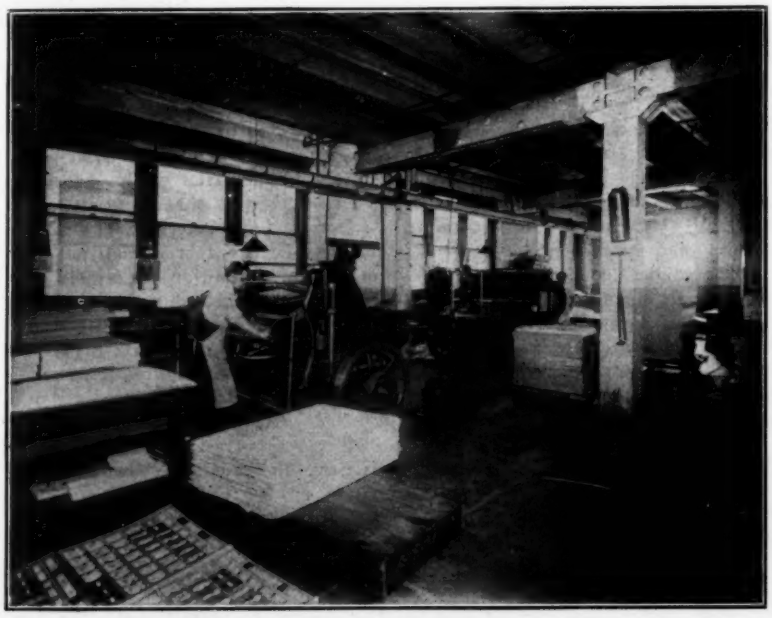
With proper compounding, a smaller size frame may be used than when the percentage for series turns is too small, because it is often the case with printing machinery where there are heavy peaks in the load, as the table reverses or the impression is taken, that the sparking limit is reached before the overheating limit, and it is necessary not only that the motor should be large enough to do its work without overheating, but also it must be large enough to take peak loads without sparking.

Interpoles are now largely used by manufacturers to get over this difficulty. The interpole machine is no more efficient than any other, but will allow of a greater overload being carried temporarily without its reaching the sparking limit. The use of interpoles, therefore, enables a smaller size frame of motor to be used in cases where the load varies so as to cause sparking, even though the average load is not more than the motor is designed to carry.

The next point to consider is the speed, and this is most important, because price depends very largely upon the speed, and a compromise has often to be struck between questions of economy in first cost and of running cost. In selecting a suitable speed, it should be remembered that the slower it is the longer will be the life of the motor, also that a larger reduction than 5 or 6 to 1 is inadvisable in a single belt or gear.

Alternating-current motors give equal satisfaction for printing-press drive. Where a constant speed is required, the squirrel-cage induction motor is recommended. For variable-speed machines the motors should be provided with slip rings by which resistance is introduced into the rotor for decreasing the speed. Single-phase motors are also extensively used for job presses, flat-bed presses and allied machines. These motors should be of the compensated repulsion-induction type, which have the characteristics of high starting torque, close speed regulation and high power-factor. These motors are entirely automatic in starting and can be connected directly on the circuit by means of a knife switch. They can be arranged for both constant and variable speed. Data on control of printing-press motors together with horsepower requirements of various makes and sizes of presses were given in an article published in our issue of May 18, 1912.

The proper selection of a motor for driving any printing press is a matter which requires careful consideration. Any motor at any speed will not do. In



Motor-Driven Paper Cutters.

order to obtain maximum efficiency the motor should be exactly the right size, the speed should be chosen with due regard to the operating conditions of the press, and the control should be such that the press can be operated at its maximum or minimum speed with the greatest efficiency.

An inexperienced man or one not fully familiar with printing-press requirements will invariably recommend a motor that is too large rather than one that is too small. He knows that a motor too small for the intended duty will give trouble from the outset, whereas one that is too large will only betray the fact by the amount of current it consumes. He will, therefore, always make a conservative guess. This certainly emphasizes the need of obtaining expert advice—as the printer is called upon to pay the bills, which increase in almost direct proportion to the size of the motor.

A motor develops its greatest efficiency when operating at or about full load. Great care should therefore be taken to chose a motor which will operate at approximately full-load rating when the press is operating at its maximum speed.

The majority of press manufacturers know what horsepower is required to drive their various sized presses, and several motor manufacturers have full data on this subject in their files.

**Electric Heating.**

Electric heat is destined to play an important part in the printing field on account of the necessity for accurate control, speed and cleanliness. At present electric heat has been successfully applied to linotypes and monotypes, glue pots and matrix dryers.

Electrically heated linotype pots have been used with success in a number of installations. At present they are only available for direct-current circuits, but it is stated that alternating-current heaters will soon be developed. The consumption of these heaters averages seven amperes, with a maximum consumption of 15 amperes and a minimum of 3.5 amperes, on 120-volt circuits.

Electrically heated matrix drying tables, as used in newspaper offices in the preparation of the matrices from which stereotype plates are cast, form one of the most successful examples of the application of electric heating apparatus to industrial work. In newspaper work the time element is of paramount importance. Every minute that can be saved in getting an extra or sporting edition on the streets after the news is received, means a better paper and additional sales. Hence the value of the electric matrix dryers, by means of which from three to five minutes can be saved on each page, over the older steam drying process.

In the preparation of a newspaper page for the press, the first step is to obtain an impression on a mould or matrix of the type composing the form. To accomplish this, a damp, spongy sheet of material about one-sixteenth inch thick is placed over the form and this matrix is pressed onto the type and rapidly dried under a heavy pressure. The dryer is composed of a flat bed in which are placed the electrical heating elements which raise the temperature of the dryer, form and matrix to a high value. When completely dried, this matrix, carrying a faithful, clear-cut impression of the type, is removed from the dryer and placed in the plate-casting machine. Here are cast the semi-cylindrical plates which are to be mounted in the presses for the production of the paper.

When it is recognized that one matrix is commonly used for the casting of from four to a dozen plates and may at times be used for as many as 60 plates, it will be seen that it is of the utmost importance to obtain a perfectly uniform and dependable product; and this is made possible by the use of electric dryers.

In the past it has been customary to operate the matrix presses by a hand wheel and screw, a slow and laborious process. The presses were heated to a working temperature by means of steam supplied under pressure from a main boiler plant or from a small, gas-heated steam generator mounted directly beneath the bed of the press. In either case a large amount of heat was liberated into the surrounding air on account of the large radiation surface of the massive construction necessary to withstand the steam pressure. Considerations of safety and economical design limit the pressure of the steam to 80 pounds per square inch, corresponding to a steam temperature of 320 degrees Fahrenheit. A matrix may be

Group of Job Presses.

Motor-Driven Stitcher.

dried by this method in from 4.25 to 12 minutes, depending upon the amount of open space in the forms and the quality of the absorbing pads. By substituting compressed air for the hand wheel, a quick certain pressure is obtained, which can be definitely fixed at any desired value and which remains constant during the whole drying operation. Control of the pressure is obtained by means of an easily operated air valve. By the use of electric heaters a higher temperature can be secured than with steam, the melting point of the type metal being the only temperature limit, and thus the drying process can be completed in a much shorter time than is possible with steam. Perfect matrices are obtained with the electrically-heated presses in from 1.25 to 3 minutes.

# Commercial Practice
# Management, Rates, New Business

## Industrial Electric Heating Association Formed at Toledo on May 1.

The Industrial Electric Heating Association was organized at a meeting held in Toledo on May 1. For several months preparations have been under way looking toward the formation of an association of men actively interested in the development of this soon-to-be-important branch of the central-station industry. The final steps were taken when some 30 men, at the invitation of A. K. Young, new business manager of the Toledo Railways & Light Company, and Henry O. Loebel, of Henry L. Doherty & Company, met in Toledo, adopted a constitution and elected officers.

Those whose names appear as charter members of the new association are: Thomas F. Kelly and J. C. Matthieu of Dayton, Frank A. Coupal of Buffalo, C. F. Hirshfeld and Ward D. Dygert of Detroit, B. G. Tarkington of Jackson, O. O. Acuff of Massillon, M. S. Caldwell of South Bend, W. E. Quillen of Alliance, E. P. Bassett, C. D. Carlson and B. P. Rueterink of Cleveland, H. E. Johnson of Chicago, I. B. Terry of Cincinnati, Frank Thornton, Jr., and H. M. Brooks of Pittsburgh, V. L. Blanchard, A. W Little, F. J. Derge, M. A. Hill, H. J. Kunz, S. L. Kelly and A. K. Young of Toledo, S. H. Knopp, John A. Seede, H. Fulwider and C. W. .Bartlett of Schenectady, and Henry O. Loebel and Frank B. Rae, Jr., of New York.

The officers elected were A. K. Young, president; Homer J. Kunz, secretary; and an Executive Committee consisting of Henry O. Loebel, chairman; C. F. Hirshfeld, M. E. Turner, J. A. Seede and Frank Thornton, Jr.

The aims of the new organization are well expressed in the following preamble to the constitution which was adopted: "'Recognizing the opening of a new and heretofore undeveloped field in the electrical industry, the importance of which, and the possibilities for the development of whch are so great, and the present knowledge so small, it seems imperative that an organization should be perfected to study and gather together all the available information on this great subject for the benefit of its members and of the industry at large and for the exchange of ideas and data."

The meeting was called to order by A. K. Young, and the visitors welcomed by Frank R. Coates, president of the Toledo Railways and Light Company. The purposes of the proposed association were outlined by Henry O. Loebel, and discussed by Messrs. Hirshfeld, Bartlett, Thornton, Derge, Perkins, Seede, Hill and Kunz. The opinion was unanimous both that there is a definite need for an organization of the men active in the development of industrial electric heating business, and that the future of this branch of the industry promises possibilities as yet undreamed of except by a very few of those who have specialized in the work.

At the conclusion of the morning session, at which the organization was perfected, the visitors were entertained at luncheon by the Toledo Railways & Light Company at the Toledo Yacht Club, after which, at the invitation of W. A. Hill, chief electrician, they visited the plant of The Willys-Overland Company, where they inspected the electric ovens and other applications of industrial electric heating.

## Novel Display of Electric Laundry Machinery.

The Boston Edison Company has been holding a window demonstration during the last two weeks of April, of electrically-driven washing machines and ironers, at its appliance rooms on Boylston Street, Boston. The show window was dressed to show the contrast between old laundry methods and those of modern households. On the one side was erected a facsimile of a primitive negro cabin, with cracked china and rusty stove—glowing with light from a ruby electric lamp placed inside. On the other side, a modern laundry, with motor-driven machinery, was set in order. In front of the "cabin," a negro mammy, with bandanna headgear, was busy scrubbing clothes in a wooden tub, while opposite a housewife sat in comfort, reading a newspaper, while electric power did the work.

The laundry apparatus displayed was the Thor, manufactured by the Hurley Machine Company, Chicago and New York. A Thor washer of the family size, driven by a one-sixth horse power Fort Wayne motor, was in operation; also a Thor electric ironer.

Change of window setting came with the first of the month, when the Easy washing machine and the Duntley vacuum cleaner were substituted. This arrangement will be in place for two weeks. The novel window displays of the Edison Company are always "drawing cards."

## Wiring Campaign at Portland.

The Cumberland County Power & Light Company, Portland, Me., is making a special campaign to promote house-wiring for electricity during the Spring clean-up period of May. The company offers to provide a complete electrical installation for seven rooms, including attractive fixtures, for $42, the householder to select any contractor in Portland, South Portland or Woodford to do the work. It offers to receive payment in 12 installments of $3.50 each, covering a year.

The companuy is displaying the fixtures included in the offer, at its Congress Street show room, and also at its branch show room in the E. W. Childs Company's store in Woodford.

## Dayton Power Contract.

The Dayton Power & Light Company has closed a contract with the Oakwood Street Railway Company, of Dayton, O., by which it will furnish current for the operation of the street railway lines.

The new contract became effective May 1, and will add about $20,000 a year to the gross earnings of the station.

## Electric Light Sells Real Estate.

A real estate operator of Rockford, Ill., who wished to dispose of a group of building lots in a sub-division just outside the city limits, conceived the idea of installing electric lighting so that prospective purchasers could inspect the property at night. Accordingly, a contract was entered into with the Rockford Electric Company and a special pole line constructed to the sub-division where an installation of high-efficiency lamps was made.

The lighting of this property attracted considerable attention and many visitors inspected lots at night. The entire sub-division comprising 200 lots was sold in 30 days, and the operator claims that this phenomenal record is due entirely to the electrical installation and the resultant advertising.

The contract with the Rockford Electric Company was made for a period of three years, the rate for service being $60 per month. The company at the end of the contract period will be entirely reimbursed for the line and will then discontinue the street lighting unless the property owners see fit to continue the payments. Aside from this revenue, however, the company is assured of over $200 per month from residences now being built.

## Denver Vacuum Cleaner Campaign.

Preceding the spring cleaning season the Denver Gas & Electric Light Company conducted a vacuum cleaner campaign which resulted in many sales. The principal feature was a letter sent to every prospective purchaser written on a special letterhead portraying a Red Cross army marching on its way with an electric vacuum cleaner on the shoulder of each soldier. The letter, signed by Clare N. Stannard, commercial manager of the company, read as follows:

"Our vacuum cleaner brigade have shouldered their vacuum cleaners and will be on the job until every home in Denver is spick and span.

"Next week is Clean-up and Paint-up Week and we mean to see that every family in Denver is given an opportunity to try our cleaners.

"The countersign of our Red Cross men is 'Clean-up and Paint-up.' When they come to your door and give you this countersign, please admit them. They will show you how easy it is to clean the carpets and upholstery. In fact, these cleaners are nearly human in their operation. They make your home fairly shine and they put disease germs where they will do no harm.

"A vacuum cleaner is the best health insurance. Celebrate clean-up week by taking out this kind of insurance."

## Central - Station Publicity Campaign in a Municipal Lighting Plant Situation.

In connection with the proposed establishment of a municipal electric light and power plant at Perth Amboy, N. J., the Public Service Electric Company, supplying service to that community, has inaugurated an effective and interesting publicity campaign, taking the form of a series of informative announcements on the subject at issue in local papers.

Following a special election, arranged for the purpose of voting bonds for $150,000 to provide for the erection of the plant, these announcements have explained to the public both sides of the question, laying particular stress upon the efficiency, convenience and economy of central-station service. In this, a forceful argument has been created to inspire due and careful consideration of the exact conditions of the plan and activities under contemplation.

**Facts For Taxpayers To Consider in Connection With Street Lighting Situation**

Whether Perth Amboy shall enter into a new contract for the lighting of its streets, with the Public Service Electric Company, or undertake the establishment of a municipally operated plant, is a question which interests the taxpayers of the city mightily.

And there are two sides to the question.

Much has been said, in a general way, about the alleged advantages of a municipal plant.

Comparatively little has been said, thus far, on the other side of the question.

Advocates of a municipal plant have, for the most part, been dealing in generalities; have been "going it blind;" accepting unsupported statements as facts and apparently building hopes upon any old kind of promises held out by those who have set their minds upon forcing the city into a business venture which it is not well equipped to handle.

Public Service Electric Company is in the business of generating and distributing electrical energy for light and power. It is a very complex business, the successful management of which calls for a high degree of technical skill and the most careful attention to the minutest details of operation. This company has all the advantages that come with the possession of a large force of trained experts, which no small plant could hope to enjoy because of the expense involved. These advantages are backed up by years of experience in the art and the Company, because of the large territory it serves, has such exceptional facilities for producing and distributing energy that it can serve Perth Amboy with all the street lighting its necessities demand more economically and more satisfactorily than the city can serve itself.

With Public Service Electric Company, street lighting is a commodity which it has to sell. Perth Amboy is one of its markets. Like the merchant who has goods to offer to customers, the Company intends to advertise its wares so that the citizens and taxpayers of Perth Amboy may know the facts and be able to judge for themselves as to the relative value, from their standpoint, of a continuation of the contract lighting system, with prices definitely fixed, and the proposed policy of forcing the city into a venture, which at best, is a hazard and an uncertainty.

Whatever the outcome may be, the taxpayers will have to pay the bills. For this reason the Company submits that the lighting situation resolves itself into a plain business proposition which should be settled according to business principles, without bias or prejudice.

For its part, the Company proposes to deal in facts—not generalities—facts which will stand the test of analysis and from time to time, through these columns, it will lay before the taxpayers, the people who pay the bills, what it believes will be convincing reasons why Perth Amboy would not be doing a wise or prudent thing to saddle upon itself a heavy bonded indebtedness, for a plant it does not need, and which would add to, rather than lessen the burdens it is now called upon to bear.

We make the assertion that a new lighting contract will be cheaper for the city than a municipal plant. We believe we will prove the truth of this assertion to the satisfaction of the taxpayers of Perth Amboy. Watch for the facts and figures.

**Public Service Electric Company**

Fig. 1.—First of the Series of Advertisements.

Issued in a series of five advertisements, and appearing at suitable intervals, these announcements afford a detailed survey of the situation from the broad viewpoint of the intelligent citizen, giving pertinent data and statistics which cannot fail to interest such class of readers.

The first announcement, shown in Fig. 1, takes up the subject of "Facts for Taxpayers to Consider in Connection with the Street Lighting Situation," introducing the subject in attractive and readable form. It indirectly points out the essential features of the company's "Reason Why" campaign to follow, and awakens interest in the future announcements to appear.

**Proposition Made to Perth Amboy Council by Public Service**

Public Service Electric Company has said that there are TWO SIDES to the Perth Amboy street lighting situation. It has further said that it intended to tell its side in such a manner that the taxpayers—the ones who will have to pay the bills—would be able to judge as to the relative merits of contract lighting and a municipally operated plant.

A contract for street lighting has the merit of a DEFINITE, FIXED RATE. That much must be conceded.

The cost of a municipal plant can only be ESTIMATED in advance.

Thus it becomes a question of a CERTAINTY against an ESTIMATE or an UNCERTAINTY.

It will be the Company's effort to demonstrate that a municipal plant is so much of an uncertainty and that its operating and maintenance expenses are so likely to exceed the cost of contract lighting that all fair-minded and right-thinking taxpayers will favor a continuance of the contract service because it will be to their best interests and to the best interests of the city so to do.

First of all, let us see what Perth Amboy has been paying, and what the Company has offered.

Last year Public Service received from Perth Amboy for Street Lighting the sum of $27,673.25, made up of the following items:

| | |
|---|---|
| 279 Arc Lamps @ $80.00 | $22,320.00 |
| 2 Type W. Flame Arcs @ $120.00 | 360.00 |
| 55 100 C. P. Incandescents @ $32.75 | 1,801.25 |
| 28 Excello @ $84.00 | 3,192.00 |
| Total for the year | $27,673.25 |

Although the city government paid only twenty-five per cent. of the cost of the Excello lamps, the balance had to be paid by certain taxpayers, and as all city income is received from taxpayers, it amounts, in the last analysis, to practically the same thing as if the city paid the whole bill.

Instead of merely continuing the former service the Company has offered to furnish a new type of lighting, under a five year contract, so that the city will receive an equal amount of illumination at the following cost:

| | |
|---|---|
| 220 400 C. P. Type "U" Mazda Lamps | $21,462.50 |
| 55 100 C. P. Incandescents | 1,789.15 |
| | 23,251.65 |
| Less 2½% for a five-year contract | 581.29 |
| Total for the year | $22,670.36 |

Here is a proposed reduction of $5,002.89 per year for the same amount of lighting, or, if the city desires it can acquire eighty additional lamps and pay no more than it paid last year.

The proposed installation would improve Perth Amboy's street lighting and the new lamps to replace the Excellos would burn all night instead of for the existing short hour schedule.

If the city and the taxpayers can get what they want in the way of street lighting, at a fair price, what have they to gain in accepting an UNCERTAINTY which will cost them more money?

More later.

PUBLIC SERVICE ELECTRIC COMPANY.

Fig. 2.—Second Advertisement in Perth Amboy Campaign.

Announcement in Fig. 2 sets forth in detail the "Proposition Made to the Perth Amboy Council by the Company," affording a concise statement relative to present cost of street-lighting service and the substantial reduction to be evidenced under a five-year agreement for central-station opera-

tion, or a total of about $25,000 for the period.

Announcement in Fig. 3 is based upon the "Difference in Cost Between Contract Lighting and Municipal Plant," giving a comprehensive idea as to the expenditure required for the establishment, maintenance and operation of the municipal station. This shows an aggregate annual amount considerably in excess of the lighting contract proposed by the company.

## Difference in Cost Between Contract Lighting and Municipal Plant

Under the lighting contract which expired December 31, 1914, Perth Amboy taxpayers were paying Public Service Electric Company at the rate of $27,673.25 a year for street lighting service.

Of this amount $3,192 was for the special installation of Excello lamps on Smith street. The fact that the city, as a city, was only chargeable with twenty-five per cent of this sum does not alter the main fact that the whole amount was contributed by taxpayers.

Public Service has offered a new contract under the terms of which the city can get just as much illumination for its streets and the total cost to the taxpayers will be about $5,000 per annum less than the old figures.

There is one other advantage to be gained under the proffered contract. The Excello lamps above referred to burn on what is termed a short hour schedule, which is as follows:

"On each Saturday and each week day preceding a legal holiday to eleven o'clock P. M. On every other week day to ten o'clock P. M. And on each Sunday to nine o'clock P. M."

In the recent offer made to the city it is provided that the new lamps shall burn ALL NIGHT, EVERY NIGHT on Smith street, as elsewhere in the city. And street lights afford added protection to property. Every lamp is like a policeman on guard for crooks and burglars shun the brightly lighted places.

If Perth Amboy cannot get service from a municipally operated plant as cheaply as it can under a contract, of what benefit would such a plant be?

If a municipal plant to provide street lighting would cost the taxpayers more than a contract would, what justification would there be for such a plant?

Public Service has offered to provide a definite amount of street lighting at a fixed price of $22,670.36. With a contract, the city would know just what it would get and what it would be expected to pay.

What would a municipally operated lighting plant cost the taxpayers? Who knows?

Perth Amboy is talking about spending $150,000 for a lighting plant. What would such a plant cost to maintain? Without going into the question of operating costs, which will be considered later in one of these articles, let every taxpayer do a little figuring for himself.

To borrow $150,000 on bonds the interest at 5% would be $7,500. Depreciation at the rate of 7 per cent a year, which is a conservative figure, would mean $10,500 a year more. At present the city is getting 2% franchise tax on its lighting cost, which, on the basis of last year's figures, amounted to $553.46. This would be lost if a municipal plant took the place of a contract, so that these three items alone would represent $18,553.46 per annum.

To operate a plant it takes coal, supplies and labor. The coal item alone for such a plant as Perth Amboy would require would be upwards of $8,000 a year. Lamp renewals would run into thousands of dollars more, without considering labor costs and other supplies. So where would Perth Amboy get off with a municipal plant as against a contract service for less than $23,000.

The evidence is against the economy of a municipal plant, and this evidence will be made more convincing when the detailed operating costs are presented, as they will be.

As we said before, the question of street lighting is a plain business proposition, and should be considered as such.

PUBLIC SERVICE ELECTRIC COMPANY.

Fig. 3.

The fourth announcement, Fig. 4, explains "Some of the Items Which Figure in Cost of a Municipal Plant," covering the subject in detail with regard to local cost of generating electrical enegry, station and labor items, and overhead charges, as well as auxiliary features that go to make for efficient operation. It is here indicated that the difference in cost between the two plans at issue would represent a yearly sum of about $14,000 at the switchboard,

The last announcement, Fig. 5, sums up the situation with "A Few More Facts Which Enter Into the Cost of a City Lighting Plant," and enters into the factors of distribution, lamp renewals, etc. This shows an aggregate amount of over 50 per cent reduction, annually, in favor of the five-year lighting proposal tendered by the company, or a total closely approximating $25,000. The company further explains the facilities at its command, and the ability of the central station to render effective and economical service.

This series of central-station announcements sets forth an interesting and carefully thought-out plan of procedure to meet situations of this character, serving as a considerate appeal to the reason of consumers and citizens. As a suggestive campaign for kindred activities along this line elsewhere, the announcements afford particular advantage; as a whole, they are framed to meet an existing condition from both viewpoints, and to all possible mutual benefit in the itnerests of company and consumer.

## Some of the Items Which Figure in Cost of a Municipal Plant

We have stated that it will cost Perth Amboy taxpayers more money to operate an electric plant for lighting of the streets than the same amount of lighting can be bought under a contract with Public Service.

Authorization has been given for an issue of $150,000 bonds which are to run fifty years, and bear interest at the rate of four and one-half per cent.

Four and one half per cent. on $150,000 means $6,750 per year.

All property depreciates after it is put in use. Lighting plants are an exception only in the sense that they depreciate more rapidly than the average property. Engineers estimate that seven per cent. is a conservative figure for plant depreciation, and seven per cent. on a plant costing $150,000 is $10,500 a year.

Thus interest and depreciation charges will account for $17,250 a year.

But the law under which the bonds are to be issued requires that a sinking fund of not less than one per cent. of the amount of the principal shall be set aside every year for the redemption of the bonds at maturity.

One per cent. of $150,000 is $1,500 annually to be added to the $17,250 fixed charges above specified.

Here we have $18,750 for interest, depreciation and sinking fund, and if the City surrenders a portion of its franchise taxes, as it will if it stops buying light, it will lose something like $500 more.

In the figures above set forth, not one dollar has been included for operating expenses.

Do the advocates of a municipally operated plant contend that they can run such a plant for the difference between the fixed charges indicated herein and the $22,670 for which Public Service offers to provide illumination under a five year contract?

No sane man would make such a claim.

Let's consider the generating plant alone, leaving distribution costs out of it for the time being.

To produce the required amount of Electrical Energy 2,465 tons of coal would have to be consumed, which, at a price of $3.50 a ton, including handling, would mean $8,627.50 a year.

Add this one item to the overhead charges and lost taxes and the total is already nearly $5,000 in excess of what contract lighting would cost.

But coal is not the only item of station cost. To run a plant requires engineers and firemen and a station helper, and oil and waste and other supplies and repairs to apparatus and building as time goes on.

A chief engineer at $150 a month would cost $1,800 a year; and three engineers at $3.00 per day, two firemen at $2.25 per day, and a station helper at $2.00 per day, would send the bill up $5,657.50 a year more, making the labor cost for the station alone $7,457.50 a year.

Will the advocates of a municipal plant contend that the power station work can be properly done by less than seven men? Will they argue that the wage figures given above are too high?

Experience shows that where municipal plants are concerned the wage figures given herewith are too low. They were purposely put low so that we cannot be accused of overdrawing the facts.

We want the taxpayers to do some thinking, for as we said before, they must pay the bills whether it is to be a contract or a municipal plant.

We say we will deliver street lighting at a definite, fixed figure.

We have given a price of $22,670.36 for the service

We have shown that the interest, depreciation, sinking fund and lost taxes for a municipal plant would be more than $19,000; that the coal bill would be $8,000 more, and that station labor would eat up $7,450 on top of that. Oil, waste and station supplies would mean $1,000 a year, and repairs would average upward of another $1,000 a year during the whole life of the plant.

Take all these items together and you have $37,050 for current AT THE STATION. To distribute it would cost thousands more.

Wherein can Perth Amboy save money? Of what benefit would a municipal plant be to the taxpayers who would have to pay the bills? Instead of a benefit it would be an expensive luxury.

PUBLIC SERVICE ELECTRIC COMPANY.

Fig. 4.

## A Few More Figures Which Enter Into the Cost of a City Lighting Plant

We have set forth a few facts concerning the cost of a municipally operated electric plant such as certain persons are advocating for Perth Amboy, and have also made comparisons between those facts and the offer Public Service Electric Company has made to the city for a new contract for street lighting.

So far, we have told only a part of our side of the story.

We have shown that the Company is willing to give the city as much light as it is receiving at present at a cost of $22,670.36, or $5,002.89 less than was paid by the taxpayers under the contract which expired December 31, 1914.

We have directed attention to the fact that a bond issue of $150,000 at 4½% interest and 1% sinking fund means an annual outlay of $8,250 for these two items alone.

We have further demonstrated that depreciation at 7% will mean $10,500 a year additional; that coal will account for $8,627.50 yearly, that the labor bill will foot up at least $7,457 more, and that other power station expenses, taken with the foregoing operating and fixed charges will necessitate the raising, in some manner, of about $37,000 a year.

And be it remembered that no allowance is made in that $37,003 for the maintenance of a distribution system—for the conduits, pole lines and lamps necessary to make use of the energy to be generated in a station, if one is built.

To light Perth Amboy, lamps will be needed, of course. And lamps wear out and have to be replaced with new ones. Before they wear out they have to receive more or less constant attention. Somebody has to be "always on the job." And this means labor charges for the distribution system in addition to the labor charges at the plant.

For a lighting installation such as Perth Amboy requires and as Public Service offers to supply under contract, the company figures that the annual distribution operating costs would be about as follows:

| | | | |
|---|---|---|---|
| Lamp renewals | | | $8,000.00 |
| Overhead line repairs, material | | | 600.00 |
| Underground line repairs, material | | | 200.00 |
| Labor: | 1 lineman | $1,095.00 | |
| | 1 helper | 624.00 | |
| | 1 lamp man | 702.00 | |
| | | | 2,421.00 |
| Total cost for distribution | | | $11,221.00 |

Taking these figures together, the cost of a lighting plant to the taxpayers of Perth Amboy would be upward of $48,000 a year, as against $22,670.36, the price offered by Public Service under a five-year contract.

Why such a discrepancy? How can the Company do it? The taxpayers might well ask.

The answer is simple.

Public Service has a thoroughly modern plant in operation in Perth Amboy. It operates extra large generators, which make for economy of production. The amount of current necessary for lighting the streets of Perth Amboy is only a very small fraction of the total output of the station, so that only a very small fraction of the fixed charges would have to be placed against the city's lighting business. If the city had its own plant, all the fixed charges would be chargeable to the city's own service.

In the same manner the labor costs are divided over a great volume of business and only a small fraction would be chargeable to the Perth Amboy lighting. Again, the city would have no opportunity for sharing its labor costs with other business. It would have to stand it all.

It stands to reason that the great plant, with its tremendous output can get more economical results than a small plant with a limited production. It is so in every business. It is especially so in the case of an electric generating station, where the current must be produced as it is used, and used as it is produced.

These are facts for the taxpayer, to ponder. It is the taxpayer who will have to pay the bills.

Talk is sometimes very cheap, but electric plants cost real money.

Perth Amboy has nothing to gain by having a municipal lighting plant. It has much to lose. Let every taxpayer think it over.

PUBLIC SERVICE ELECTRIC COMPANY.

Fig. 5.

## Electric Cooking Equipment at Texas School.

The Wolvin School at Texas City, Tex., has recently equipped its domestic science department with 10 Hughes electric hot plates and a Hughes electric range.

## House-Wiring Campaign at Manchester.

The Manchester (N. H.) Traction, Light & Power Company, in co-operation with five local electrical contractors, is prosecuting a house-wiring campaign, offering to furnish and install fixtures, Edison Mazda lamps and shades, with necessary wiring, for parlor, front hall, dining room, bathroom, upper hall, bedrooms, porch, kitchen and pantry, for $52.

Wall switches are provided for parlor, dining room, porch, cellar, and front hall, the latter provided with a three-way switch for control of light from both floors. All wiring is concealed and the offer promises to leave the house unmarred.

The company's territory is about 32 miles square. Already 6,000 homes are electrically connected in the city of Manchester itself, but a large number of houses are still unprovided with electrical conveniences, in the country districts. The offer applies to all the company's territory.

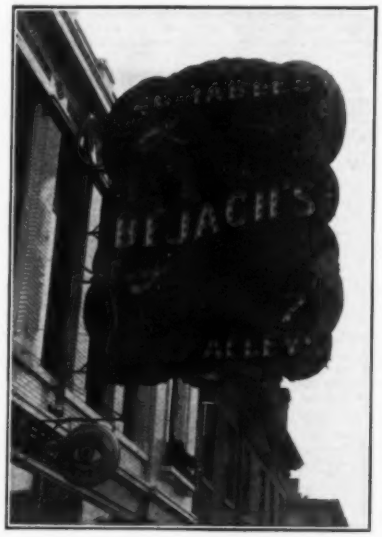
Besides the Manchester company's large hydroelectric generating stations at Garvin's and Gregg's Falls, and a steam auxiliary in the city, the system is tied in with the plant of the Amoskeag Manufacturing Company, which operates the largest collection of cotton and woolen mills in the country. Connection is also provided with the generating plant of the McElwain Shoe Company. A reciprocal arrangement is in effect by which, in case of emergency, the Manchester company will furnish energy to either manufacturing plants, and in return draw upon them for a temporary supply.

The Manchester Traction, Light & Power Company operates electric railway lines throughout the region extending to Nashua and Derry on the south, and to the Concord line on the north. The company is just 25 years old, and has been under the management of J. Brodie Smith since it began business in 1890.

## Spectacular Electric Sign in Cincinnati.

One of the most striking, and, by reason of its location, one of the most conspicuous electric signs in Cincinnati, has recently been placed in operation at the new Bejach billiard hall, on Vine Street, by the Quehl Sign Company, of Cincinnati. A view of the sign is shown in the accompanying illustration. Its operation, which is accomplished by means of a Reynolds Electric Company flasher, is as follows, 42 switches being used to make the different moves involved: The word "Bejach," occupying the center of the sign, in 18-inch letters, burns steadily; the upper part of the sign showing the words "26 tables," and the figure of a man at a billiard table, is flashed on first, the player being shown in position to play. He aims at the ball, draws his right arm back, and then shoots it forward in the rapid motion required for the play. The ball is then shown moving through the intricacies of a difficult shot.

The entire upper part of the sign goes off after this play is accomplished, giving way to the bowling alley and bowler shown below, with the words "7 Alleys." The bowler, with the ball in his right hand, aims for his play, with left arm outstretched. The right arm is then drawn back for the shot, and as it comes forward rapidly, the left



Spectacular Electric Sign in Cincinnati.

arm drops, the whole movement being extremely natural. The course of the ball down the alley is shown, and the lights representing the pins all go out —the bowler makes a "strike" every time. Then this part of the sign flashes off, and the upper part is started again.

The sign measures about 11 by 15 feet, and is double-faced, the two sides being identical in every respect.

There are 772 lamps used, 728 being clear-bulb 10-watt tungstens, 62 having red frosted bulbs, to show the movement of the red "cue ball" in the billiard shots, while 44 are two-candlepower candelabra lamps used in outlining the two cues shown, and in indicating the tops of the ten-pins.

The background is in black, painted on a 20-gauge galvanized open-hearth iron base, of which the sign is constructed. The lettering is all in white, the "grooved" type of letter being used. These letters are outlined with a galvanized metal shoulder fixed at right angles to the base of the sign, and painted inside with a contrasting color to that used outside, forming an excellent reflector for the lights, and making the letters stand out strikingly.

Two slender torches on each side of the sign, with ribbon effects and plumes of flame, add an attractive decorative touch. They are painted and lighted in bronze, while the bows of ribbon are in blue. The border around the whole sign is in green enamel, with a decorative outline in gold leaf. The figures of the two players are in natural colors, with dark clothing and white shirts, while the billiard table is in mahogany and green and the bowling alley in maple, both following closely the actual colors. The outlines of the table and alley are made by lamps furnished with Betts & Betts amber color caps.

## Louisville Gas and Electric Offers Prizes for Employees' Co-operation.

Supplementing the plan broached recently to employees of the Louisville Gas and Electric Company that they use their personal influence in increasing the company's business, is the offer of a series of prizes for the employees who are most active in that direction. Each employee on May 5 found in the envelope with his or her pay check a bulletin from the commercial department, stating that the employee who before the first of June turned in the names of the most prospects in the house-wiring campaign, who also could be closed with by that date, would be presented with a vacuum cleaner which retails at $19.50. It was announced also that other electrical appliances would be awarded to those who trailed the leaders.

Employees who interest friends and acquaintances and who telephone the names of such persons into the department will state that they are entered in the employees' contest and give their names as well as those of the prospects. These latter will be solicited at once and reports made according to results. The house-wiring proposition during May is particularly attractive, including as it does the offer of a month's free electricity for all who contract for wiring installations before June 1 and providing for particularly low rates for wiring of four-room cottages. The officers of the company are in hopes that the prize offer will get vigorous co-operation from the 500 to 700 employees of the company, and, it is stated, if the results justify the plan, awards to winners will be continued monthly.

United States firms have furnished over 40 per cent of the electrical machinery and supplies used in Brazil, but not through any concentrated effort. It was because the street-railway and light and power systems in various cities are under the management of Americans.

# Electrical Construction

## INTERCOMMUNICATING TELEPHONE SYSTEMS.[1]

By T. F. Lee.

Public telephone service is accepted as a very real necessity, and in most modern business establishments, as well as in many private houses, a private telephone system is recognized as being a necessary part of the office or house equipment.

Probably the most popular and useful private telephone system is one by means of which it is possible from any one instrument to ring up any other instrument directly, without having to first call up an exchange, i.e., a system in which no switchboard or operator is necessary.

Such a scheme is now usually described as an intercommunicating telephone system, or more briefly, an interphone system.

It may consist of two or more telephones, but as an installation of two instruments only, requires none of the selecting mechanism usually associated with an interphone system, I will refer mainly to systems having three or more telephones.

One of the problems in an interphone system is to arrange the supply of current economically, and conveniently to feed all.

The most obvious way is to use induction-coil instruments, with a small battery at each.

Many interphone systems have this arrangement, which is known as the local-battery system, and it gives entirely satisfactory results.

Another system, however, known as the central-battery system, is now very frequently used.

This employs one battery only at the center of the system, the object being to reduce the number of cells to be looked after, and to concentrate these at one point.

With a telephone system the object is to obtain battery current through the transmitter, and to vary this current by speaking into the transmitter, the circuit being so arranged that this varying current passes through the receiver.

This object can be achieved by connecting the two transmitters and primary coils of a pair of instruments in series with the line, and connecting up each receiver in a local circuit with its secondary coil and no battery.

If now, a battery is connected across the two wires of the line at the center of the circuit, with a retardation coil between each wire and the battery, we shall have the necessary conditions for speaking.

A retardation coil consists of many turns of wire round an iron core, and its special peculiarity is that, while a direct current from a battery can pass through it, retarded only by the resistance of the coil, alternating and varying currents find a very much greater opposition, so that the steady battery current passes out easily over the line and through the transmitter.

This steady current is changed to a varying current by the transmitter being spoken into, but this varying current can only find a path over the telephone line.

It cannot pass through the retardation coil, and so it cannot interfere with the steady battery current, except in the line itself, i.e., the battery remains entirely unaffected by the varying speech currents.

This same battery can be connected through similar retardation coils to other lines, and other instruments, but with each pair of instruments the varying currents, which produce the speech, are confined to their own lines by means of the retardation coils.

So far we have considered only the speaking portion of the telephone systems, and have said nothing of the ringing or signaling part of the apparatus.

As this, in interphones, is only an ordinary bell circuit embodied in the apparatus, however, there is no need to consider is very fully.

Each instrument has a bell and push button, and the ringing battery is nearly always a separate battery of cells located at some mid point on the system, and fed to the telephone instruments over a pair of ringing leads run right round the system.

### Interphone Circuits.

It is practically impossible, in a short paper, to examine in detail the circuits of the various interphones on the market, but if they are treated on general lines, and if these general lines are well understood, it is a comparatively simple matter to trace out the actual circuits themselves.

I have found it simplest to divide an interphone into two parts: (*a*) the telephone proper, which includes the transmitter, receiver, induction coil, switch hook, and bell; and (*b*) the selective portion, consisting of keys, dials, levers, or whatever selective scheme is fitted.

The telephone part can always be traced out to a fairly simple form of battery-ringing telephone, and the selective part consists simply of—firstly, a series of contacts connected normally to the line wires, but not to the telephone part; and, secondly, a switch, or series of switches, connected to the telephone part, and arranged so that the connection can be made as desired to any one of the contacts mentioned.

If, now, we consider that with each instrument the telephone part is connected permanently to one line only (the home line), and that this line runs through every other instrument, but is only connected to the selective part, we have the principle upon which every interphone system is designed.

### Selective Systems.

The selection of the line is usually effected in one of three ways:

(1) *The Rotating-Arm System.*—With the cheaper instruments a rotating arm makes connection with a number of contacts, each contact being connected to one telephone line.

Every telephone line must, of course, consist of two wires, but one of these wires may be common to all the lines, so that only one wire, and a common return, are required.

The rotating arm can only conveniently be used with such a system, as it is difficult to satisfactorily fit contacts for two line wires, so obtaining a double-wire system.

(2) *The Push-Button System.*—With the push-button system a wedge opens out two springs, which make connection with two other springs forming the line contacts.

(3) *The Lever-Switch System.*—With the lever-switch system, the same action as with the push buttons takes place, but lever switches are substituted.

With all three systems, the selective apparatus should be arranged to automatically return to the normal, when

1 Portion of a paper presented to the Association of Supervising Electricians.

the receiver is replaced on the telephone.

**Single and Double Line.**

Mention has been made of systems having one line wire for each instrument, and a common return wire for all, and also of systems having two line wires for each instrument.

A considerable amount of wire is, of course, saved by having a common return, but this has disadvantages.

If a varying current is passing through a wire, this will tend to induce or set up varying currents in wires in the neighborhood, and if two pairs of telephones have their wires close together, as in an interphone system, it is possible for one wire to set up such strong currents in another wire, that the speech going on between one pair of instruments can be heard in the other.

This is known as induction, and is unavoidable with single-line circuits.

If double wires are used, however, they can be twisted together in pairs, and the varying currents set up in one wire of the pair will be equal, and opposite, to those set up in the other wire of the pair, and so they neutralize one another, no induction or cross talk (as it is sometimes called) results.

Here it may be mentioned that with bad insulation of the wires, and in the instruments, actual leakage of current from one wire to the other may take place, and this will also cause cross talk.

This is frequently described as induction, but it is quite an incorrect description.

**Secret-Service Interphones.**

If the principles of the interphone system, as previously given, are considered it will be seen that at any one of the instruments it is possible to select any other, therefore two instruments can select the same line and a third can overhear the conversation of the other two.

This has led to the design of secret-service interphones which lock out the line as soon as conversation commences.

Such instruments are, however, complicated, since a relay is necessary at each instrument, and relays require very careful attention in maintenance.

It is very doubtful if, in most cases, the result obtained is worth the additional cost and extra trouble and attention necessary, as the fault of being able to listen in is not a very serious matter in most places where interphones are fitted.

The Western Electric push-button interphones allow of limited secret service between two or three instruments, without the addition of a relay, and this result is obtained by the use of extra push buttons, an entirely separate circuit from the regular interphone circuit being set up between the instruments concerned.

There is theoretically no reason why interphones should not be constructed for 50 or 60 lines, but the fact that the more lines there are, the greater is the chance of the conversation being broken into and the busier is the system as a whole, has led makers to limit interphones to about 25 lines.

The cost of cable, moreover, makes the price of larger systems very high.

Regarding the length of line, it will be seen that this is practically limited by the bell.

The speaking system fitted is usually suitable for some miles of line, but battery bells, as is generally known, can only be relied upon on fairly short lines.

Moreover, the same battery which is used to ring the bell from an instrument only a few feet from the calling instrument is also used to ring the bell of one instrument from the calling instrument at the other end of the system, so that if the line is very long, a bell will sometimes get enough current to ring it to pieces, and sometimes not enough to ring it audibly.

These considerations limit the distance apart of the two most distant instruments, and with a good set of instruments the limiting distance may be taken as about 2,000 feet.

**Cable.**

One of the most important points to consider with interphones is the correct choice of cable.

The wires must be well insulated and of low capacity.

Rubber and gutta percha give the wire a large capacity, i.e., cause serious losses in transmission, but paper, silk, and cotton give a low capacity, i.e., reduce the transmission losses.

Long telephone lines, therefore, are never made with rubber-covered wire.

In interphone systems, the lines are never very long, but nevertheless it is advisable to keep down capacity and so rubber is better omitted. This has the additional advantage of keeping down the cost.

Interphone cables for indoor use are best made with tinned copper wire, insulated with silk and cotton, then braided and waxed, the wax helping to keep out dampness and to bind the loose ends of the silk and cotton lappings.

As many wires are required in such cables, they should be arranged with a definite color code, i.e., each wire or one wire of each pair should be lapped with a differently colored cotton.

In order to reduce the effect of induction, as previously mentioned, the wires should be twisted in pairs.

Where the cable is required out of doors, the same cable is used, lead-covered.

For single-wire circuits a large wire must be inserted for the common return.

Unless this wire is considerably larger than the other wires, it will increase the cross talk.

**Installation.**

The secret of success of an interphone system, and the freedom from trouble in use, depends upon two factors, good instruments and careful installation.

With regard to the first, if instruments of recognized makes are used the installer need have very little fear, and it is safe to say that 90 per cent of the trouble experienced with interphone systems is due to careless installation at the outset.

Good installation depends mainly on neat and methodical wiring and arrangement.

The following points should be carefully considered when planning out an equipment:

(1) The most suitable instrument for the work should be chosen.

(2) The shortest length of cable should be used.

(3) The most suitable cable should be chosen.

(4) As few wires and connections as possible should be made in the instruments themselves.

(5) The question of suitable batteries should be carefully considered.

The question of whether local-battery or central-battery sets should be used should receive attention.

Local-battery sets have perhaps rather simpler circuits and one battery going wrong does not throw out the whole system, but there are more batteries to maintain.

Central-battery sets are usually a little more expensive, but there is a considerable saving on batteries, and the battery maintenance is simpler and cheaper.

The second item, the shortest cable route, is an important one.

The most obvious method of installing cable is simply to run it from one instrument to another, but the ideal method is to fix all the instruments on the circumference of a circle and run all the cables to a junction point at the center, like spokes in a wheel.

This has the great advantage that each instrument is exactly the same length of cable from any other, and so ideal ringing and speaking conditions are obtained.

The best practical solution usually lies between the two, i.e., to group two or three instruments together with a cable, and to run cables from each group to a more or less central point.

With regard to the third point, viz., the choice of cable, it is only neces-

sary to see that indoor cable is not used in damp places or in places where it is subject to rough treatment, and that lead-covered cable is not dented or damaged in bending.

The fourth point is a very important one also.

Not more than one cable should be run into an instrument, and junctions of two or more cables should be made in junction boxes, which means, as a rule, that each instrument should have one junction box fitted.

Before making connections, the wires should be formed out.

To do this a forming board is required, which consists of a piece of board with nails protruding from it at the same distance apart as the connectors in the set or in the junction box.

The cable is stripped back for about a foot, leaving the wires loose. These are then taken, and each wire is bent around a nail.

The tapering bunch of wires is then bound up with waxed string, and the cable when removed from the board will have all the wires in the correct position for fixing in the instrument or junction box.

Dry cells of good quality are undoubtedly the best to use, as they are cheap, clean, and easily renewed.

Regarding actual installation I suggest the following:

(1) Plan out the system as a whole.

(2) Run all cable, fixing permanently in position and leaving plenty of space where junction boxes occur.

(3) Mark the positions of instruments and junction boxes and lace out the cables on the forming board to fit these positions.

(4) Fix instruments and junction boxes in place and wire up.

(5) Install the batteries.

(6) Thoroughly test out the system before handing it over.

**Faults With a Local-Battery System.**

(*a*) If it is not possible to hear one instrument speak on any of the others, the transmitter circuit (i.e., battery, transmitter, primary of induction coil and switchhook) should be examined on the faulty instrument.

(*b*) If it is not possible to hear on one instrument, examine the receiver circuit (i.e., receiver secondary of induction coil and connections thereto, including selector contacts).

(*c*) If it is not possible to ring one instrument from any other, examine the bell circuit of that particular instrument.

(*d*) If it is not possible to ring any instrument from one particular instrument, examine the push-button circuit including connections to the battery.

(*e*) If ringing is weak or unsatisfactory, examine the ringing battery, and look particularly for short-circuits in the ringing circuits on junction boxes and instruments.

(*f*) If both speaking and hearing are unsatisfactory when one instrument calls or is called, examine the home line of this instrument for short-circuits. (This will usually occur at the instrument terminals or at one of the junction-box terminals.)

(*g*) If the service is generally satisfactory but poor speaking and listening, and a certain amount of cross talk is sometimes experienced, it will be found that two wires of different lines are in contact. This contact can usually be discovered by examining the junction box and instrument terminals, but if this does not show the fault, it can be found by disconnecting all home line connections and testing at one of the junction boxes for contacts between the line wires. This can be done by means of an ordinary bell and battery.

Regarding faults on central-battery interphone systems, these are in general very similar to those on local-battery systems and can be found in the same way.

Any short-circuit or similar fault will, however, tend to run down the central speaking or ringing battery, and so will not be confined so strictly to one instrument, but will affect the whole system.

It will, however, show most plainly on the instrument in connection with which the fault occurs.

In conclusion, I would remind you that telephones are delicate scientific instruments, and like all scientific instruments, can only be satisfactorily handled by those who understand them.

That the trouble and time spent in learning to understand the telephone, will be well repaid, I am quite convinced, because I am quite sure that the telephone habit is in its infancy, and that there will be a growing demand for telephones, and more particularly for private telephone installations, and it must naturally follow that the engineers and electricians who have made themselves familiar with telephone apparatus will be the ones to benefit by this extended use of the telephone.

## Meeting of Winnipeg Contractors.

The contractors of Winnipeg, Manitoba, on March 5, 1914, organized the Master Electrical Contractors' Association of Winnipeg. On March 25, 1915, the annual meeting of this association was held at the St. Regis Hotel, Winnipeg.

Addresses were made by President Riggs, Secretary May, J. W. Marsh, J. H. Schumacher, S. A. Barber, H. W. Billings, C. Marriott, C. T. Kummen, and F. A. Cambridge.

## Licensing in Massachusetts.

A hearing on a bill relative to the registration of persons or concerns engaging in electric wiring was held by the Massachusetts Legislative Committee on Ways and Means April 21. The measure under consideration is the outgrowth of a petition for legislation by the Electrical Contractors' Association and others, on which a hearing was held early in the session. At that time strong support to the measure was given, not only by the contractors but also by the electrical workers.

Opposition developed on the part of labor union leaders, particularly those representing the telephone industry. The new bill is a substitute for the Senate report of the Committee on Public Lighting, which referred the earlier bill to the next General Court.

This measure provides that after September 1, 1915, no person or concern shall engage in wiring for electricity without a license issued by a board of three examiners to be appointed by the Gas and Electric Light Commissioners, one of whom shall be a practical electrician, the second an electrical inspector and the third "shall have such qualifications as may be deemed most advisable by the commissioners."

Frequent examinations shall be held in Boston, and twice a year in five other cities of the state.

Two forms of licenses are provided for: Certificate A, issued to master electricians, i. e., to any person or concern conducting a wiring business; Certificate B shall be issued to journeymen electricians after examination by the board, on proof of fitness and of having gained their livelihood at the occupation of electrician for five years prior to application. Fees for license certificates are fixed at $25 and $1, respectively, and are for one year, expiring each July 31. Renewal of certificates may be had for $15 and 50 cents, respectively.

The penalty for engaging in electrical work without license is $10 to $100 for the first offence. This applies to employees as well as to masters. A concern holding an "A" certificate shall not be liable for work done by employees without authorization, unless with the knowledge or consent of the former.

Telephone, telegraph, transmission and railway companies and their employees are exempt from the provisions of the bill; and learners, apprentices, theatrical and regular corporation employees are not required to take out a regular license. Electric light plants are also exempt.

Electric wagons for removing refuse from the streets are being employed by the most progressive European cities.

### Louisville Pushing Fan Sales.

Though it is only the first of May the early arrival of hot weather has had a bullish effect on the electric fan market—referring to used fans. The film exchanges and the houses which handle motion-picture supplies have been besieged by proprietors of the smaller theaters, for second-hand fans, while the owners of larger theaters are also inquiring as to what will be the possibilities in this line. The supply of used fans, however, is greatly below the demand and the theater owners are turning to the dealers for new goods. The fact that Louisville has seen probably ten new moving picture houses added to the number already in existence since the last season, which is declared to be the prevailing ratio of increase over the country, indicates the extent of the market for fans this year.

An effective display of the Colonial electric fans handled by the James Clark, Jr., Electric Company is attracting much attention in Lou sville. The company has put into the window a variety of these fans, of the several models which are carried, so positioned that cross currents of air are formed. A quantity of white confetti in the inclosed display space is kept constantly agitated and the motion attracts all who pass.

### Toronto Contractors Organize.

The electrical contractors and dealers of Toronto, Can., held a meeting on April 16, and determined to form a permanent organization. The committee appointed for this purpose consists of E. A. Drury, P. Scott, F. W. Palmer, George D. Cole and W. H. Lodge.

A discussion was indulged in regarding inspection fees and price cutting.

Martin Neelon acted as temporary chairman and Mr. Lodge as secretary.

### Ohio Contractors' Convention.

A meeting of the Ohio Electrical Contractors' Association will be held in Cincinnati on May 12 and 13. Headquarters will be at the Hotel Havlin. Contractors from other states, as well as members, are invited to attend the meeting. The secretary of the association, is F. M. Grant, 1529 Prospect Avenue, Cleveland.

### New Jersey Segregates Electrical Work.

New Jersey has passed a law requiring separate specifications and bids and separate awards of contracts on electrical work as well as on plumbing and gas fitting, and on heating, ventilating and steam equipment, in all public buildings in that state.

### Contractors and Central Station Co-operate in South Africa.

The city of Durban, South Africa, has a municipal electric plant. We learn from *Electrical Industries* that electrical contractors in Durban have been in negotiation with the Durban Town Council over the sales question, and a scheme has been drawn up calculated to assist the distribution of electric cooking and heating devices on easy terms. The Council has agreed to the following scheme:

(1) That it be left to contractors to sell heating appliances to consumers without the intervention of the Corporation, and, if the consumer is unwilling or unable to pay cash, the Corporation to pay the seller outright and collect the money from the consumer by instalments, and in order to safeguard against financial loss, all applications be considered jointly by the town treasurer and the borough electrical engineer, and that the joint decision of those officials be final.

(2) The Corporation only to take part in such a transaction if the contractor's price includes a guarantee of maintenance against faults not due to misusage for one year.

(3) The Corporation to add six per cent to the price charged by the contractor to the consumer.

(4) The scheme to include not only the appliances, but any necessary wiring.

(5) The scheme not to apply to any purchases under the value of $36.

(6) Payment to extend up to six months for material up to $50 in value, and up to twelve months for material over $50 in value.

(7) Consumers to be required to pay a deposit of 25 per cent cash on receipt of the goods, leaving the balance to be paid thereafter in instalments, the period of payment not to extend over twelve months.

### Washington Electrical Contractors Organize.

The most prominent electrical contractors of Washington, D. C., have formed an organization for the promotion of their business interests, for good fellowship, and for combating any unjust rules, regulations or practices. The association will work harmoniously with the public. Meetings will be held on the first and third Friday of each month at the Builders' Exchange. Officers have been elected as follows: president, Robert Smith, of the Capital Electric Company; vice-president, Joseph Randall, of H. P. Foley Company; secretary, John J. Odenwald; treasurer, W. B. Watzel. Opportunities to come in as charter members are still open and several contractors have expressed their intention of taking advantage thereof.

### Among the Contractors.

The Pierson-Wilcox Electric Company, Minneapolis, Minn., has secured the contract for the electric wiring for three residences on Lake of the Isles Boulevard being erected for Emery Mapes, Frank Mapes, and Mrs. G. V. Thompson. The houses are steel-frame, hollow-tile and concrete construction. The electrical equipment comprises a very complete system of lighting with burglar alarm, auxiliaries, call bells, interphones, etc., all in conduit, and when complete will be a thoroughly up-to-date installation in every respect.

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The Hatfield Electric Company, of Indianapolis, Ind., is completing the electrical work on the First National-Soo Building, one of the skyscrapers of Minneapolis.

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Albert Wheeler has opened a store at 1197 St. Clair Avenue, Toronto, Canada, where he will carry a full line of electric fixtures, lamps, household devices, etc. He will also continue his contracting business.

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N. B. Oppen, of Stoughton, Wis., an electrician of long experience, has purchased of Klein & Company, Deerfield, the latter's entire stock of electrical fixtures and supplies. He will do a contracting business in Deerfield.

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Fred Gratz, former city electrical inspector, Madison, Wis., will go into the electrical contracting business. He may open a shop at West Johnson and North Orchard Streets.

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Andersen & Dibben have established themselves in business at 522 West Monroe Street, Chicago. They are prepared to undertake work in mechanical and electrical elevator repairs, motors, generators, wiring, fire-alarm systems, call bells and annunciator systems.

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The Smith & Liermann Electric Company, formerly of Fond du Lac,Wis., and now located at Juneau, will open a branch store in Brandon. The company will carry a complete line of electric fixtures and supplies, as well as do an electrical contracting business.

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For the benefit of creditors, R. Wilkerson and R. C. Isaacs, doing business as the Wilkerson Electric Company, Louisville, Ky., have made an assignment to Paul Tafel, of the H. C. Tafel Electric Company. The assets approximate $600 and the liabilities are estimated to be about twice that amount. The Wilkerson Electric Company has been in the electrical contracting business in Louisville for about two years.

# Public Service Commissions

Conducted by William J. Norton

## ARIZONA.

**Standards for Gas and Electric Service.** Rules were adopted by the Arizona Corporation Commission, effective May 1, 1915, fixing the standards for accuracy of gas and electric meters, testing of meters, and regulation of voltage. Electric meters are to be tested at least once in two years, and no meter is to be installed or allowed to remain in service which has an error of registration in excess of three per cent on light load, half load, or full load. The following rules were adopted by the Commission to aid the company in securing payment for service rendered:

"(No. 21). Any utility supplying gas and electricity, who detects the fraudulent use of gas and electricity by a consumer, may discontinue the service, and need not reinstate same until an amount shall be paid to the utility covering the estimated amount of such commodity fraudulently used, and a charge of $2.00 to cover extraordinery expenses incidental thereto. In such case the utility shall estimate the amount of gas or electricity fraudulently used, from previous or subsequent meter readings or other proper data.

"(No. 22). Every public service utility supplying electricity or gas shall use diligent methods in the collection of its accounts, with the purpose of largely eliminating the loss of revenue through bad debts and to reduce the working capital necessary in the operation of the utility. With this in view any public service utility may discontinue the service of a consumer who is delinquent in his account for gas or electricity in excess of 20 days. All amount due the utility for gas service or electric service and a charge not to exceed $2.00 per meter for extraordinary expenses may be collected from the consumer by the utility before the service is again rendered."

## CALIFORNIA.

**The Pacific Gas and Electric Company.** In the case of Speciale vs. Pacific Gas and Electric Company, decided March 18, 1915, the company was ordered to restore service to complainant, under proper guarantee for the payment of future bills. The complainant, G. Speciale, had a three-year contract with the Pacific Gas and Electric Company for the furnishing of electric energy for pumping purposes. The power was to be furnished for a 20-horsepower motor, for which service the complainant was to pay an annual minimum of $120. During the second year of the contract the pumping plant failed, due to drought, and the bill for energy consumed was only $25.90. The complainant refused to pay the minimum bill, alleging that "the failure of the water supply was an act of God." The following year there was sufficient water supply. The consumer desired the service, but the service was discontinued, and the company refused to restore the service unless the balance due under the contract for the past year was paid. The Commission says: "The complainant did not request the defendant to discontinue his service when he was able to obtain water, and defendant therefore continued in readiness to serve complainant and to meter and bill him for such energy as was consumed. I think that the question whether or not the failure on the part of the complainant to fulfill his part of the contract was due to an act of God is one not necessary to be considered by this Commission in this proceeding, but should be decided by the courts.

"Pending such determination by the courts, or if defendant waives its right to sue for the amount it claims to be due, it appears to be but fair that complainant should be required to guarantee defendant any future bills, and in order to do so, should pay in semi-annual payments, in advance, his minimum bill."

## DISTRICT OF COLUMBIA.

**Interest on Deposits.** The following decision was rendered, effective May 1, 1915: "The Public Utilities Commission on its own initiative investigated the practices adopted by the several utilities in the District of Columbia for protection against loss due to non-payment of bills by their customers. It was found that all utilities requiring deposits did not pay the same rate of interest thereon, in one case five per cent being paid on such deposits, in another case four per cent, and in still another no interest was being paid.

"The Commission is of the opinion that, since these deposits are available by the utilities for use in the transaction of their affairs, a reasonable rate of return should be paid thereon by the utilities, and the customers of whom the deposits are required are entitled to a reasonable rate of return thereon; and the Commission is further of the opinion that five per cent is a reasonable rate of interest in such cases. It is, therefore, ordered: That, whenever a deposit is required of a customer by a utility, interest at the rate of five per cent be paid thereon during the time that the deposit is retained by the utility."

**The Washington Railway and Electric Company** was authorized to issue its general improvement, six-per-cent debenture bonds to the amount of $13,500, face value.

**The Potomac Electric Power Company** was authorized to issue $79,500 face value of general improvement six-per-cent debenture bonds. The proceeds are to be used for extensions and improvements, and for reimbursement of funds expended for these purposes.

## INDIANA.

**Merchants Heat and Light Company.** The Supreme Court has rendered a decision in which the action of Herbert H. Rice seeking to enjoin the city of Indianapolis from contracting with the Merchants Heat and Light Company for street lighting service is dismissed. The decision of the Marion circuit court, which was noted in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, July 25, 1914, p. 175, is affirmed. The decision of the Supreme Court gives the following summary of the case: "It is asserted by appellant that the contract is void in its entirety, and that the other provisions therein contained cannot be enforced. As a taxpayer, appellant has no interest in the contract, except in so far as its performance will affect the public treasury of the city, and having failed to show by proper allegations that any of the public funds are in danger of being illegally dissipated, the first paragraph of the complaint fails to state a cause of action. If appellee company is permitted to collect only such rates as are fixed by the public service commission, and the city is permitted to pay only such rates, appellant's rights as a private consumer of current will not be affected, as the presumption obtains that the rates will be reasonable and fair to all concerned. For this reason the second paragraph

of complaint fails to state facts sufficient to constitute a cause of action in favor of appellant as a private consumer."

### MARYLAND.

**Standards for Gas Service.** The determination of a proper standard for gas service has been before the Maryland Commission for some time. Considerable attention has been given the question of the standard or standards to govern the illuminating power of gas and the heating power of gas. In deciding whether a double or single standard is advisable, and, if a single standard is adopted, whether such standard should be based on the lighting or the heating value of the product, the Commission says the purposes for which the gas is used and the amount of gas used for the respective purposes must be considered. "We should select a standard which will enable the consumer to obtain the greatest amount of value for the price paid, and as the evidence shows that at least 90 per cent of the total consumption of gas in Maryland is used for heating purposes and not more than 10 per cent used for lighting with flat-flame burners, with a constantly increasing demand for its use for heating and a decreasing demand for its use for such lighting, it follows that the Commission should adopt such a standard as will inure to the benefit of the great majority of users." A heating standard of 600 British thermal units per cubic foot is adopted in the order of April 17.

### MASSACHUSETTS.

**Clinton White** has announced that he will retire from the Public Service Commission on May 18. He has been a member of the Commission for 20 years and he is resigning on his seventieth birthday.

### NEVADA.

**The Fourth Annual Report** of the Public Service Commission has been published for the year 1914. The seventh annual report of its work as Railroad Commission is presented separately in the same volume.

The public utility section of the report contains decisions, annual reports of the companies, Public Service Commission Law, rules for the regulation of gas and electric service, and safety rules for electric utilities.

### NEW JERSEY.

**Court Case.** The right of the Board of Public Utility Commissioners to deny its approval to the leasing of the West Jersey and Seashore Railroad and its franchises to the Pennsylvania Railroad for a period of 999 years, has been upheld by the Court of Errors and Appeals in an opinion handed down by Chief Justice Gummere.

### NEW YORK—Second District.

**North Buffalo Natural Gas and Fuel Company.** The Public Service Commission has decided that a gas company cannot charge a customer for tapping the main and for the curb box and curb cock between the main and the customer's service pipe. According to the decision of the Commission these items are capital charges for property which remains with the company and not with the customer. A charge for the installation of meter and connections is found to be a just and equitable one.

**Lima-Honeoye Electric Light and Railroad Company.** The Commission has refused to allow the Lima-Honeoye Electric Light and Railroad Company and the Lima-Honeoye Light and Railroad Company to separate their electric light from their railway business, because the Commission finds that this would be a violation of a lease of the properties between the two companies, approved by the Commission in 1910. One of the two companies, both of which are owned by the same interests, at that time leased to the other its property, for a period of five years. It has since been found that the electric light property is profitable, but that the railway is so unprofitable as to make the joint operation of the two also unprofitable. Counsel for the company admitted at the hearing that under the circumstances if the abandonment of the lease were sanctioned the operation of the railroad property would ultimately be abandoned. Discussing the right under the Public Service Commissions Law of the Commission to approve the non-operation of a railroad throughout its entirety and for an indefinite period the opinion of the Commission, by Chairman Van Santvoord, finds that the Commission has no such power, and for that reason ought not to authorize anything which would inevitably result in such non-operation.

### OREGON.

**Oregon Power Company** applied to the Commission for an interpretation of section 63 of the public utilities act, which prohibits companies from making discriminatory rates. The company, in its application for a ruling by the Commission, stated that it was furnishing electricity for lighting the stations of the Oregon Electric Railway at Albany, Corvallis, Harrisburg and Junction City, each under separate contracts. The company desired to know if it would be within a reasonable interpretation of the law for it to furnish the railway company with electricity at all stations where it has facilities for supplying it, and apply a rate for the total consumption. Under the interpretation of the law by the Railroad Commission this cannot be done, and the Commission issued the following general ruling: "An electric utility which has filed tariffs showing its rates in several distinct localities upon a block-rate plan whereby a lower rate is secured by increased quantity consumed, hereafter may not lawfully contract with a single user who desires to be served in different localities, that the aggregate amount of his consumption shall be taken and a single bill be rendered thereon, in order that the total charge made may be less than if the consumption from each use served by a single distributing system were separately computed at the tariff rate applicable to that locality."

### PENNSYLVANIA.

**Annual Report.** The Public Service Commission has made its first annual report for the period from July 26, 1913, to June 30, 1914.

### VERMONT.

**Incorporation.** An act was approved April 2, 1915, which provides that the Public Service Commission shall find that a proposed corporation will promote the general good of the state, and shall issue a certificate to that effect, before the incorporators transmit to the secretary of state the articles of association. The certificate is not to be granted by the Commission until after a public hearing to determine that the establishment and maintenance of the new company will "promote the general good of the state."

## Extension of Municipal Lines.

The Massachusetts Legislature has enacted a bill which gives the Gas and Electric Light Commission power to authorize a municipal lighting plant to extend its lines into an adjoining town that has no electricity supply. The municipal plant shall have the same rights and obligations in the town in which the extension is made as it has in its own territory.

In case the community entered should vote to establish a plant of its own it shall purchase the plant and property of the other town, that lies within its limits, and thereupon the original rights to distribute electricity shall cease.

The same law is applicable to gas plants.

A bill which provided for the installation of the Dyer electric voting machine in the two branches of the Massachusetts Legislature has been referred to the next General Court. This apparatus was described in the issue of April 17.

### Conservation of Water Power in Vermont.

The legislature of Vermont has passed an act which provides for the conservation of flood waters. It provides that the governor shall appoint a commission of three persons to serve two years, without compensation. The sum of $500 is provided annually for clerical assistance, and sufficient money to pay the commission's expenses.

The commission is charged with investigating and determining what locations are desirable for storage reservoirs to hold flood waters and benefit water powers developed and undeveloped. It may employ expert and engineering services to the value of $2,500.

The commission is to keep on file plans, surveys and drawings pertaining to its investigation, which will be copied and furnished to any person at cost. Report is to be made to the next legislature what propositions are made to it for the construction of storage reservoirs, and the commission is authorized to receive propositions and contracts by riparian owners or water-power owners for either the lease of the reservoir with the right to use and operate it, or the operation under the commission.

# Among the Supply Men

### Proposes That the Electrical Supply Jobber Guarantees Material and Service.

At the recent meeting of the Electrical Supply Jobbers' Association at Chicago, W. N. Matthews, president of W. N. Matthews & Brother, St. Louis, delivered an interesting address, taking as his subject the proposition of the electrical supply jobber guaranteeing the merchandise he distributed and the service rendered by the house and its representatives. Mr. Matthews holds that the electrical supply jobber is an economic necessity. As a middleman between a multitude of manufacturers and consumers he has established for himself a place and a function which enables the dealer and consumer to place their order for a variety of merchandise with one concern.

Reviewing the development that has come about in the demand for electrical material Mr. Matthews believes that in many directions the electrical supply jobber has been found entirely equal to the emergency, while in some other directions service development has rested upon the manufacturer. The reasons for many manufacturers developing a sales organization that in a measure is parallel to that of the jobber, are five-fold:

First—The tremendous strides taken by the industry, a growth that is equaled by only two industries in the entire history of commerce.

Second—Inability of the earlier jobbers at first to give service in a broad sense, because of the highly technical nature of merchandise and the lack of trained salesmen. This, coupled with scant capital, made the pioneer electrical supply jobber unequal to the rapidly growng industry.

Third—The consequent timidity on the part of the jobber to stock goods until the market was created by the manufacturer. When this was done, it gave the manufacturer control instead of the logical distributor—the electrical supply jobber.

Fourth—Hand in hand with the phenomenal growth of the electrical business was the development of productive advertising. The electrical manufacturer has always been a creative advertiser, which has placed him foremost in the thoughts of the electrical buyer.

Fifth—The heretofore comparative lack of ruinous competition between manufacturers meant more liberal profits and easier manufacturing conditions; consequently more time to devote to strictly distributing questions.

The growth of the manufacturers' sales organizations has had a restricting influence upon the extension of the jobbers' sales organizations. As a remedy for an undesirable situation that is developing, and in order that the electrical supply jobber might be ultimately the logical distributor of electrical manufactures, Mr. Matthews proposes that the jobber guarantee the efficiency of his employees and the quality of the merchandise he distributes. If care is exercised in selecting the brands of merchandise handled, which may be backed by an absolute guarantee upon the part of the manufacturer and in turn guaranteed absolutely by the distributor, the dealer and the consumer will be relieved of asking any questions with regard to quality, and will be concerned only with respect to the speed with which he may secure a delivery of his order. Matthews holds that there is very little that the jobber might handle that cannot be bought from some manufacturer who will protect him in an absolute guarantee. If the material handled by the jobber is restricted to the lines that may be absolutely guaranteed it will mean that every manufacturer to have his line recognized and handled by the jobber must produce the very best class of goods, and that his guarantee must be back of every article that he makes.

A complete stock of absolutely reliable goods with few duplications will result in more turnovers, more satisfied customers, more goods sold at regular prices, more net profit and more rock solid foundations for enduring success.

By handling the fewer lines the jobber and his representatives will be able to devote more thought and energy to the sale of these few lines.

Mr. Matthews advocated the policy of "money back if goods are not satisfactory," and pointed out numerous instances in modern manufacturing and merchandising where this policy had built up an enviable reputation and contributed to a substantial success.

### Western Electric Company's New Kansas City Warehouse.

The Western Electric Company's distributing house in Kansas City, Mo., is now located in new quarters at 608-610 Wyandotte Street, opposite the old building which served as its Kansas City headquarters for the past ten years.

The new building is five stories in height, with cellar and subcellar all completely equipped with sprinkler system. It has dimensions 50 by 175 feet, affording about 52,000 square feet of floor space. Switch-track facilities have been so arranged that freight cars can be spotted without interfering with either the shipping court, store or offices.

The top floor of the building is devoted to the shop and the returned-goods section; standard-package stock is on the fourth floor; broken-package stock is on the third floor; and offices on the second floor. The city counter and display room are on the first floor, occupying the frontage on Wyandotte Street. The remainder of the first floor is devoted to fast-moving stock and to the shipping and receiving department.

# Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

## DIRECT CURRENTS.

**Problem 35.**

A 40-ton electric car with its two series motors connected in series runs at a speed of 10 miles per hour on a straight level track and takes a current of 8 amperes from the trolley wire, which is at a potential of 600 volts above the track. The train resistance of this car is $4+0.13S$ pounds per ton, where $S$ is the speed of the car in miles per hour. The combined resistance of the armature and series field of each motor is 0.6 ohm.

Find the current and power taken from the trolley wire and the speed of the car under the following conditions, assuming that the air-gap flux of each motor is proportional to the armature current: ($a$) motors connected in series, track level, and trolley voltage 500 volts; ($b$) motors connected in parallel, track level, and trolley voltage 600 volts; ($c$) motors connected in parallel, track level, and trolley voltage 500 volts; ($d$) motors connected in parallel, trolley voltage 600 volts, and car ascending a two-per-cent grade. ($e$) With the motors connected in series, trolley voltage 600 volts, and speed of car 10 miles per hour, what current and power will the car take from the trolley wire when it is accelerated on a level track at a rate of one mile per hour per second?

### SOLUTION OF PROBLEM 35.

**Answer to Question a.**

The air-gap flux being assumed proportional to the armature current, the current-flux torque of the armature of each motor by [46] is proportional to the square of the armature current. Neglecting the stray-power torque, the current-flux torque of each motor is proportional to the train resistance, since it is the current-flux torque that drives the car forward and balances the train resistance at any speed. The train resistance at 10 miles per hour is $4+0.13\times10$ or 5.3 pounds per ton. Since the armature current is 8 amperes when the train resistance is 5.3 pounds per ton, the speed ($S$) for any armature current ($I$) is given by

$$5.3/(4+0.13S)=64/I^2$$

Simplifying,

(1) $S=(I^2-48.3)/1.57$ miles per hour.

The speed of a motor armature by [45] is directly proportional to the armature voltage and inversely proportional to the air-gap flux. Since the air-gap flux is proportional to the armature current, the speed is also inversely proportional to the armature current. Each motor armature is geared to the driving wheels so that the armature speed of each motor must also be proportional to the speed of the car.

At 10 miles per hour, with the motors connected in series and the trolley voltage 600 volts, the terminal voltage of each motor is 600/2 or 300 volts. The armature voltage of each motor by [3] is then $300-8\times0.6$ or 295.2 volts. At a trolley voltage of 500 volts and with an unknown armature current ($I$), the armature voltage of each motor is $250-0.6I$. Since the speed of the car is directly proportional to the armature voltage and inversely proportional to the armature current, we have

$$10/S=295.2I/(250-0.6I)8$$

Simplifying,

(2) $250-0.6I=3.69SI$

Substituting for $S$ in (2) its value as given in (1) and simplifying the resultant equation we have

$$I^3=106.3+48I$$

This is a cubic equation and may be solved by several different methods. In this case it may be solved quite easily by giving $I$ several definite values until one is found which fits the equation. By this process the current is found to be 7.85 amperes. The speed by (1) is then 8.53 miles per hour. The power by [19] is $500\times7.85$ or 3,925 watts.

**Answer to Question b.**

If the motors are connected in parallel, with the trolley voltage 600 volts, equation (1) still holds, but since the armature voltage of each motor is $600-0.6I$ equation (2) will read

(2) $600-0.6I=3.69SI$

Solving as before, $I$ equals 8.78 amperes and $S$ equals 18.3 miles per hour. The motors being connected in parallel, the current taken from the trolley wire is $2\times8.78$ or 17.6 amperes. The power by [19] is $17.6\times600$ or 10,560 watts.

**Answer to Question c.**

The trolley voltage being 500 volts, equation (2) will read

(2) $500-0.6I=3.69SI$.

Solving (1) and (2) as in the Answer to Question ($a$), $I$ equals 8.53 amperes and $S$ equals 15.6 miles per hour. The current taken from the trolley wire is $2\times8.53$ or 17.1 amperes. The power by [19] is $17.1\times500$ or 8,550 watts.

**Answer to Question d.**

The car must be driven up an incline in which the ratio of the distance the car is raised to the distance the car travels is two per cent. In addition to the train resistance the motors must then develop a tractive effort of 20 pounds per ton for each per-cent grade or a total tractive effort of $4+0.13S+2\times20$ or $44+0.13S$ pounds per ton. Then

$$5.3/(44+0.13S)=64/I^2.$$

Simplifying,

(1) $S=(I^2-531)/1.57$.

The trolley voltage being 600 volts, equation (2) reads

(2) $600-0.6I=3.69SI$.

Solving (1) and (2) as before, $I$ equals 23.3 amperes and $S$ equals 7.65 miles per hour. The current taken from the trolley wire is $2\times23.3$ or 46.6 amperes and the power by [19] is $46.6\times600$ or 27,960 watts.

**Answer to Question e.**

The force required to accelerate a car exclusive of that required to overcome train resistance equals the mass of the car multiplied by the acceleration. Measuring the acceleration ($a$) in miles per hour per second, the force required to produce an acceleration ($a$) is $100a$ pounds per ton weight. At a speed of 10 miles per hour and acceleration of one mile per hour per second the total tractive effort is then $4+10\times0.13+100\times1$ or 105.3 pounds per ton. Then

$$5.3/105.3=64/I^2$$

and $I$ equals 35.6 amperes. The motor being connected in series, the current taken from the trolley wire is also 35.6 amperes and the power taken from the trolley wire is $35.6\times600$ or 21,360 watts.

An examination of the above results reveals the following facts regarding the operation of an electric car.

(1) For any fixed connection of the motors the speed of the car decreases with the trolley voltage. In this case a change of trolley voltage from 600 volts to 500 volts reduced the speed from 10 to 8.53 miles per hour for series connection and from 18.3 to 15.6 miles per hour for parallel connection. It should be noted that the trolley voltage on any electric traction system varies considerably throughout the system, the voltage in general being lowest at those points farthest away from the source of power.

(2) The car runs faster with the motors connected in parallel than when

## ALTERNATING CURRENTS.

**Problem 85.**

A three-phase rotary converter is rated to deliver 300 kilowatts at 220 volts on the direct-current side. At full load, when operating at a power-factor of 0.90, it has an efficiency of 91 per cent. In the following problem this rotary receives power through transformers from a three-phase, 2,200-volt circuit. The transformers should be rated so that the rotary can operate at 0.90 power-factor when delivering 300 kilowatts without overloading them.

(*a*) If the transformers are connected in star on both their primary and secondary sides, what should be the kilovolt-ampere rating and the voltage ratio of each? (*b*) If the transformers are connected in delta on their primary and in star on their secondary sides what should be the kilovolt-ampere rating and the voltage ratio of each? (*c*) If the transformers are connected in delta on both their primary and secondary sides what should be the kilovolt-ampere rating and the voltage ratio of each? (*d*) In question (*c*), if one of the transformers is burned out, what is the greatest kilovolt-ampere input to the rotary that will not overload the remaining transformers? (*e*) If the transformers are connected in delta on their primary sides and have their secondary sides arranged so that the rotary can supply power to a three-wire Edison circuit, what should be their voltage ratio of transformation?

connected in series. This principle is used in accelerating the car, the motors being first connected in series and in series with a resistance which is gradually short-circuited. The motors are then connected in parallel and in series with a resistance which is again gradually short-circuited, the motors being connected in parallel at full speed without series resistance.

(3) The power taken by a car is usually much greater during acceleration or in climbing a grade than it is at full speed on a level track. Electric car motors must then be designed in general with greater regard for the power requirements when starting or climbing a grade than for full speed on a level track. There is an exception to this statement in the case of very-high-speed cars, since the wind resistance may be sufficient to require a very heavy tractive effort at the motors even when running on a level track.

### SOLUTION OF PROBLEM 85.

**Answer to Question a.**

In a rotary converter the same armature conductors serve to generate both the direct and the alternating voltage. The direct voltage depends upon the total flux in the air gap. The alternating voltage depends not only upon the total flux but also upon the way in which it is distributed in the air gap. The only method of changing the ratio between the direct and the alternating voltage is by changing the *distribution* of the flux in the air gap. This is accomplished in practice by using what is known as the split-pole. When calculating the ratio between the direct and the alternating voltage it is customary to assume that the latter is a sine wave. Under this condition the ratio is

$$E_{ac}/E_{dc}=0.707\ sin\ (\pi/n)$$

$n$ is the number of phases, except in the case of a single-phase rotary, when $n$ equals 2.

For single-phase,

$$E_{ac}/E_{dc}=0.707\ sin\ (\pi/2)$$
$$=0.707$$

For three-phase,

$$E_{ac}/E_{dc}=0.707\ sin\ (\pi/3)$$
$$=0.612$$

For four-phase,

$$E_{ac}/E_{dc}=0.707\ sin\ (\pi/4)$$
$$=0.50$$

For six-phase,

$$E_{ac}/E_{dc}=0.707\ sin\ (\pi/6)$$
$$=0.354$$

For a three-phase, 220-volt rotary the alternating voltage is

$$E_{ac}=220\times 0.612$$
$$=135 \text{ volts.}$$

Since the transformers are connected in star on the low-tension side, the voltage on this side should be

$$E_2=135/\sqrt{3}$$
$$=78 \text{ volts.}$$

The high-tension voltage is

$$E_1=2{,}200/\sqrt{3}$$
$$=1{,}270$$

The ratio of transformation therefore is

$$E_1/E_2=1{,}270/78$$

The input to the rotary on the alternating-current side is

$$300/0.91=330 \text{ kilowatts}$$

Since the power-factor is 90 per cent, the kilovolt-ampere input is

$$330/0.90=367$$

This load is equally divided between the three transformers, so that the kilovolt-ampere rating of each should be

$$367/3=122 \text{ kilovolt-amperes.}$$

**Answer to Question b.**

Since, no matter what method of connection is used, each transformer supplies one-third of the total kilovolt-amperes, the capacity of each transformer is the same, viz., 122 kilovolt-amperes. If the transformers are connected in star on their secondary sides, the low-tension voltage will be the same as in (*a*), viz., 78 volts. With the primary windings connected in delta the high-tension voltage is 2,200 volts. The ratio of transformation is

$$E_1/E_2=2{,}200/78$$

**Answer to Question c.**

For the reason given in (*b*) the capacity of each transformer is 122 kilovolt-amperes. With the secondary windings connected in delta the low-tension voltage equals that of the rotary, viz., 135 volts. The ratio of transformation is therefore

$$E_1/E_2=2{,}200/135.$$

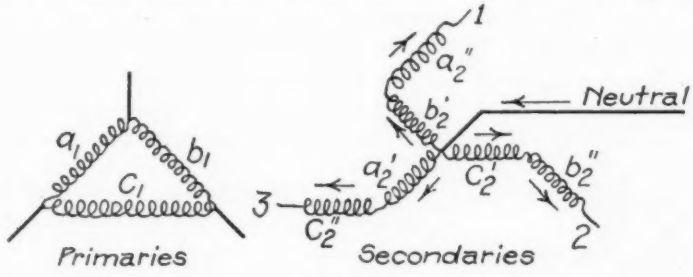


Fig. 38a.

**Answer to Question d.**

If one of the transformers is burned out it leaves the other two operating in open delta, or $V$. The voltage of each transformer is unchanged but the current now becomes equal to the line current. If $I_o$ represents the full-load current of one transformer, the greatest value that the line current can have without over-loading them is $I_o$. The output of a three-phase system is

by [42a] $P=\sqrt{3}VI\cos\theta$

The greatest kilowatt output is therefore

$$P=\sqrt{3}VI_o\cos\theta/1{,}000$$

The greatest kilovolt-ampere output is

$$Kv.\text{-}A.=\sqrt{3}VI_o/1{,}000$$

## DIRECT CURRENTS.

**Problem 36.**

A power house operated at a constant bus voltage of 230 volts supplies a load of 500 kilowatts at the end of a transmission line having a total resistance of 0.01 ohm. A series generator driven by a shunt motor is connected in series with the line at the power house, the motor being connected across the line as shown in Fig. 28. The combined resistance of the field and armature of the series generator is 0.001 ohm. The overall efficiency of the motor-generator set is 80 per cent. With the field of the series generator adjusted so that the voltage at the load is equal to the busbar voltage at the power house, find (*a*) the current taken by the shunt motor; (*b*) the armature voltage of the series generator; (*c*) the efficiency of the system from the load to the power-house busbars. Find (*d*) the voltage at the load with the booster removed when the same amount of power is supplied to the load as before and (*e*) the efficiency of the line under the conditions stated in Question (*d*).

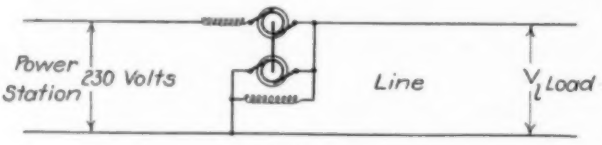


Fig. 28.

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This problem illustrates the operation of a direct-current system with and without a series booster.

## ALTERNATING CURRENTS.

**Problem 86.**

A six-phase rotary converter is rated to deliver 1,000 kilowatts at 600 volts on the direct-current side. The field structure has eight poles, each of which is wound with 1,498 shunt turns and two series turns. The armature core has 168 slots with six inductors per slot. At 25 degrees centigrade, the shunt field winding has a resistance of 76.2 ohms. In the following problem this rotary receives power through transformers from a three-phase, 6,600-volt circuit. Assume that the temperature of the field winding is 75 degrees, and that the efficiency at full load is 94 per cent. When running at no load as a shunt generator a field current of 5.65 amperes is necessary when the terminal voltage is 600 volts.

(*a*) When this rotary delivers 1,000 kilowatts at 600 volts and the shunt-field rheostat is cut out, at what power-factor will it be operating? Will it take a leading or a lagging current? (*b*) If the transformers are connected in delta on the high-tension side and diametrically on the low-tension side, what should be their kilovolt-ampere rating and their voltage ratio in order that they will not be overloaded under the condition given in (*a*)? (*c*) If the transformers are connected in star on the high-tension side and in double-delta on the low-tension side, what should be their kilovolt-ampere rating and their voltage ratio under the condition given in (*a*)?

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Answers to the above problems and two new problems will be printed in the next issue.

When the transformers are operating in delta, the kilovolt-ampere capacity of all three is

$$Kv.\text{-}A.=3VI_0/1{,}000$$

The ratio of the kilovolt-ampere capacity of two transformers operating in open delta to that of three similar transformers operating in delta is

$$\text{Ratio}=\sqrt{3}VI_0/3VI_0$$
$$=0.58.$$

Thus the greatest kilovolt-ampere input to the rotary should be

$$0.58\times 367=213 \text{ kilovolt-amperes.}$$

Notice that the disabling of one transformer reduces the capacity a little more than one-third.

**Answer to Question e.**

The proper method of connection is shown in Fig. 38a.

The secondary windings of each transformer are divided into two equal parts and connected as shown. If there is any current in the neutral it will divide approximately equally between the three transformers. Notice that in each of the secondary windings this third of the neutral current flows in opposite directions through the two halves so that its net magnetizing effect is zero. If the ordinary star connection were used, the direct neutral current would magnetize the magnetic cores in one direction. This would increase the core losses. The phase relation of the voltages across the secondary windings $a_3''$ and $b_3'$ is 120 degrees, so that the voltage from the neutral to the terminal (1) is $\sqrt{3}$ times the voltage of either winding. The voltage from (1) to the neutral is $135/\sqrt{3}$ volts, just as in question (*a*). The voltage across one of the secondary windings is

$$135/\sqrt{3}\sqrt{3}=45 \text{ volts.}$$

The ratio of transformation from the high-tension to one of the low-tension windings is 2,200/45.

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## St. Louis Jovian League Holds Ladies' Day.

The St. Louis Jovian League of Electrical Interests held its second ladies' luncheon at the American Annex Tuesday, April 27, which was attended by 76 ladies and 145 members. Mrs. William H. Utter, president of the St. Louis Women's Council, was the principal speaker. Mrs. Utter spoke on "Women's Viewpoint of the Proposed Parkway." Mrs. Utter explained that the election was not as to whether the city should have the parkway, but to determine whether the Circuit Court should appoint a commission to determine the value of the real estate which would have to be condemned if the parkway is to become a reality and to determine the cost, and to ascertain whether St. Louis can afford to have a parkway.

Other speakers were Herman Spoehrer and Ell C. Bennett.

## ELECTRICITY IN WATERWORKS PLANTS.

By L. E. Darling.

Electric drive is more or less in its infancy. Its abilities in various lines are just beginning to be determined and fully known. It has no long lineage of experimentation and past installations in every kind of power application to determine what is good and what is not. New applications for electric drive are constantly blossoming out—new places before unthought of or disregarded are continually coming to be found worth while. One of the most interesting, and until lately much neglected, of these fields is in the application of electric drive to waterworks pumping. It is with this field that this article is concerned.

Little more can be attempted than a statement of conditions as they exist today in the majority of waterworks plants and an outlining of the factors which have made waterworks plants lately develop into respectable possibilities as central-station loads. Under the head of present-day conditions, the dominant considerations are the notoriously bad and poorly co-ordinated pieces of machinery which usually fill up pumping stations, and the factors which have created this state of affairs. Under the factors which have made waterworks develop into possible electric power users comes the rise of the centrifugal pump, the advent of the large central station, and a dissatisfaction with former wasteful pumping methods.

Unfortunately, until recently but few studies of the waterworks field have been attempted. However, some timely statistics have recently been made public by the extension division of the State University of Iowa, the fruit of a summer's investigation into the status of waterworks plants in that state. One of the tables in the bulletin has especially to do with existing electrically operated plants in Iowa, and together with the accompanying notes affords much food for thought. The table, slightly rearranged, is submitted herewith.

Something should be said upon the rapid development of the centrifugal pump within recent years, which has had not a little to do with electricity's inroads upon a field heretofore held exclusively by steam and water power. The principal advantage about a centrifugal pump from an electrical standpoint is the fact that its rotor runs at a speed more nearly commensurate with that inherent in the electric motor, thus enabling the motor to be coupled directly to its load. The usual transmission loses are avoided, space saved, and noise largely eliminated.

At a recent meeting of waterworks men at the State University of Iowa, Prof. B. P. Fleming, head of the Department of Mechanical Engineering in that institution, and a man who has had much experience in irrigation and pumping on government work in western states, commented extensively on the rise of the centrifugal pump in water handling. He favored centrifugal pumps, other things being equal, on both the scores of reliability and economy. Centrifugals are gaining in reliability because men are learning to get around the faults of the earlier designs, eliminate troublesome features, and in general to incorporate more science into the general make-up of the pumps. For working where sand and twigs and such material has to be dealt with, as in the case of lifting water out of a river to filter beds, centrifugal pumps have no equal, for there are no valves to obstruct passageways nor to stick or wear loose. Sand used to wear out propeller blades rapidly, but even this feature is being successfully overcome, both by more scientific shaping of the rotor blades and by making them of a more sturdy and wear-resisting material. From the standpoint of economy in operation, Professor Fleming made the point that centrifugals can be made just as efficient as any other type of pump, contrary to the current idea, and wherever centrifugals are employed, even in pumping from deepest wells, they are giving uniform satisfaction and service. Practically the only source of power to be at all considered for the propelling of centrifugal pumps is the electric motor, since its compactness and flexibility, and small size, and the facility with which power could be gotten to it in difficult positions, such as down in a well, are making it invaluable to this sort of pumping service. The fact that the electric motor and power service have been developed to the high state of perfection now existing has had not a little to do with the commercial development of the centrifugal pump. He predicted that the centrifugal and its motor will create a revolution in pumping methods all over the country within the next few years.

Even the application of the electric motor to the ordinary reciprocating pump has been giving a great deal of satisfaction wherever tried. Numerous instances of this sort of arrangement may be noted in the accompanying tables, and the installations have been uniformly reported successful. In some of these cases the handy electric motor has saved long steam lines with consequent condensation and waste, for the wells of a waterworks plant are not always located close together or within easy range of a steam boiler. In other cases, motors were installed because power could be purchased cheaply of a large central station, eliminaing the local boilers and long hauls of coal by wagon from distant railway tracks. In others, the economies to be effected by the use of centrifugal pumps was an object.

As mentioned above, the tables in this article are based on a bulletin on "Water Works Statistics of Iowa Cities," recently issued by the Extension Department of the State University of Iowa. The data and notes recorded in the bulletin were collected by John H. Dunlap, assistant professor of hydraulics and sanitary engineering in the university, who was the principal investigator sent out by the Extension Department. The subject was covered from the broad viewpoint of finding out the general conditions under which waterworks plants of Iowa are operating, and, besides the table on electric pumping reproduced herewith, the bulletin also contains tables and additional data on "Ground Water Sources of Supply," "Consumption of Water," "Steam Pumping with Costs," "Distribution Systems," "Pressures," "Water Rates and Service," and on "Finances of Municipal Water Works," thus covering all sides of Iowa waterworks systems to a very thorough degree. The investigation was made by the Extension Department in response to continued requests from all parts of the state for definite data on current practice in the water systems of different Iowa cities. An awakening seems to be taking place all over the state as regards the status of waterworks plants, coupled with a demand for better systems, better service and more economical operating costs all around. That a marked change in waterworks plants over the state is to take place within the next few years seems certain, and it is equally evident from the present trend that electricity is to play an important part in the operation of the future plants.

In connection with the table the following points should be noted. Costs of pumps and motors do not include foundations and connections, in most cases. In the case of Rockwell City, pipe connections are included.

*Waterloo.*—All pumps are of the deep-well multiple-stage centrifugal type and raise water from deep well to surface reservoir. The first pump listed is run by three-phase, 60-cycle induction, constant-speed, belt-connected motor; the second, by same supply, only a two-speed, direct-connected motor is used. The third motor has constant-speed and is direct-connected. Pumps are 135 feet down.

Last year four new deep-well centrifugal pumps, American type, were

purchased at $1,600 each for three direct-connected pumps, and $1,300 for one belt-connected pump. Three motors were purchased at a cost of $583 each.

*Mason City.*—The first pump is a deep-well, double-action, double-rod pump, and pumps from well to surface reservoir. The other two are deep-well, multiple-stage centrifugals and likewise lift from the well to a surface reservoir only. The supply of current is three-phase, at 60 cycles. Motor on first pump runs at constant speed and is gear-connected. The other two are constant-speed, direct-connected. Costs for pumps include motors.

*Charles City.*—The first pump is a combination deep-well propeller and centrifugal, and pumps from the well to surface reservoir. The second is a vertical single-acting triplex power pump and works between surface reservoir and distribution system. The third is like the second, but works between the wells and distribution system. The last two are centrifugals and are for the purpose of pumping from surface reservoir to distribution system for fire and reserve domestic service. Three-phase, 60-cycle, constant-speed motors are used. The first and the last two are direct-connected. The others use chain drive.

*Rockwell City.*—Deep-well, double-acting, double-rod pumps in both cases, and works between deep-well and distribution system. Motor on first pump is three-phase, 60-cycle induction, con-

ELECTRIC PUMPING IN WATERWORKS PLANTS OF IOWA—WITH COSTS.

Based on Data Compiled by John H. Dunlap, Assistant Professor of Hydraulics and Sanitary Engineering, State University of Iowa.

| | | PUMPS | | | | | | MOTORS | | | | | | COST OF POWER FOR PUMPING | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Place | Number in Use | Date of Purchase | Make | Nominal Capacity in Gallons per Minute | Size in Inches | Cost Each | Number in Use | Make | Cost Each | Horse Power | Volts | Revolutions per Minute at Full Load | Rate per Kilowatt-Hour in Cents | Cost per Month | Cost per Million Gallons | Total Feet Dynamic Head | Cost per Million Gallons Pumped 100 Feet High |
| DEEP-WELL ELECTRIC PLANTS | Waterloo | 1 | 1905 | Byron-Jackson | 700 | Diameter Well 16; Discharge 8 | $2005 | 1 | General Electric | $700 | 40 | 2300 | 900 | | | | 95 | |
| | | 1 | 1910 | Byron-Jackson | 1100-1400 | Well 20; Discharge 10 | 2500 | 1 | Westinghouse | 875 | 50-75 | 2300 | 850-1150 | 2; all over $200 per month 1.5 | | | | |
| | | 1 | 1914 | American | | | 1600 | 1 | General Electric | 583 | 60 | 2300 | 1200 | | | | | |
| | Mason City | 1 | 1911 | Luitwieler | 235 | 7.75x18 | 1454 | 1 | General Electric | | 15 | 220 | 1140 | | | | | |
| | | 1 | 1912 | American | 800 | Well 16; Discharge 9 | 1700 | 1 | Sprague | | 50 | 2300 | 1160 | 1.5 | $370 | $11.00 | 107 | $10.30 |
| | | 1 | 1913 | American | 1200 | Well 19; Discharge 10 | 3400 | 1 | Sprague | | 100 | 2300 | 1165 | | 390 | 10.10 | 83 | 12.20 |
| | Charles City | 1 | 1914 | Hill-Tripp | 500 | 4 | 710 | 1 | Westinghouse | 360 | 30 | 2300 | 1200 | 2.5 for first 4000; 2 for next 5000; 1.5 for remainder | New rates not in force. | | | |
| | | 1 | | Gould | 275 | 8x10 | | 1 | Westinghouse | 346 | 20 | 2300 | 865 | | | | | |
| | | 1 | 1914 | Gould | 325-650 | 11x12 | 1530 | 1 | Westinghouse | 765 | 25-50 | 2300 | 860 | | | | | |
| | | 2 | 1914 | Gould | 500 | 4 | 350 | 2 | Westinghouse | 493 | 60 | 2300 | 1700 | | | | | |
| | Rockwell City | 1 | 1914 | Downie | 185 | 6.75x18 | 1500 | 1 | Fort Wayne | | 15 | 220 | 1200 | 3 | 85 | 34.10 | 300 | 11.40 |
| | | 1 | 1912 | Luitwieler | 210 | 7x18 | | | | | | | | | | | | |
| AIR-LIFT SYSTEMS | Waverly | 1 | | Marsh | | 8x 8 | | 1 | General Electric | | 10 | 220 | 865 | Combined Plant | | | | |
| | | 1 | | Smith-Vaile | | 8.5x12 | | 1 | Westinghouse | | 40 | 200 | 580 | | | | | |
| | | 1 | | Smith-Vaile | | 12x15 | | | | | | | | | | | | |
| | Algona | 1 | | Ingersoll-Sargeant | | 12x12 | | 1 | | | 40 | 220 | 900 | | 48.08 | | | |
| | | 1 | | Gould | | 5.75x24 | | 1 | Fairbanks-Morse | | 15 | 220 | 900 | | | | | |
| | | 1 | | Gould | | 5x 8 | | 1 | Fairbanks-Morse | | 7.5 | 220 | 900 | | | | | |
| | | 1 | | Fairbanks-Morse | 600 | 8.5x12 | | 1 | Fairbanks-Morse | | 40 | 220 | 1200 | | | | | |
| | Osceola | 1 | 1914 | Ingersoll-Rand | | | 3751 | 1 | Westinghouse | | 75 | | | | 100 | | 325 | |
| | | 1 | 1914 | Deane | | | | | | | | | | | | | | |
| | Council Bluffs | 2 | 1912 | Platt | 9000 | 20 | 1906 | 2 | Allis-Chalmers | 752 | 100 | 2200 | 720 | 2 | 275 | 3.06 | 32 | 9.57 |
| | Red Oak | 2 | | Smith-Vaile | 350 | 8.5x10 | | 1 | | | 100 | | | | | 50.00 | 196 | 25.50 |
| PUMPING FROM SHALLOW WELLS | Clarinda | 1 | | Gould | | | | 1 | | | | | | | | 50.00 | 200 | 25.00 |
| | | 1 | | Gould | | | | 1 | Westinghouse | | 5 | 200 | 850 | | | | | |
| | | 1 | | Gould | | | | 1 | Westinghouse | | 10 | 200 | 1120 | | | | | |
| | Spencer | 1 | | Deane | 110 | 5.5x 8 | | 1 | Westinghouse | | 5 | 220 | 1130 | Combined Plant | 136 | | 138 | |
| | | 1 | | Smedley | | | | | | | | | | | | | | |
| | Sheldon | 1 | | Gould | 300 | 9x10 | 3000 | 1 | Century | | 25 | 104 or 208 | 1165 | 4.5 | 249 | | 222 | |
| | | 1 | | Fairbanks-Morse | | 10x16x9x18 | | | | | | | | | | | | |
| | Sac City | 1 | | Deane | 180 | 7x 8 | | 1 | Westinghouse | | 15 | 400 | 1120 | | 150 | $90-$50 | 200 | $45-$25 |

stant-speed, belt-connected. The second pump is connected to a 30-horsepower gasoline engine. This is to be changed to electric pumping. Gasoline pumping has been found to cost six cents per thousand gallons, including interest and depreciation.

In addition to these two deep-well pumps and motors, an auxiliary steam-engine drive is in reserve; contract cost for steam, 35 cents per hour. For fire an auxiliary steam pump is available; contract cost for steam, $1 per hour. The pumping station is adjacent to the local electric power plant, thus making possible these contract costs for steam.

*Waverly.*—First pump is an air lift, deep-well to surface reservoir. The other two are horizontal duplex, double-acting power pumps and work between surface reservoir and distribution system.

Motor on first pump is three-phase, 60-cycle, constant-speed, direct-connected. The second works from the same supply, but is variable-speed, belt-connected. City electric power plant was combined with water works, no separate pumping costs being kept.

The Marsh air compressor is horizontal, single-stage, single-cylinder, with a two-inch pipe to a reservoir six feet high and three feet in diameter. From the receiver a one-inch pipe runs to well.

*Algona.*—First pump is an air lift, deep-well to surface reservoir. The second is a single-acting deep-well pump for same sort of service. The third is a vertical, single-acting, triplex power pump, which operates between surface reservoir and distribution system. The fourth consists of a horizontal, duplex, double-acting power pump and works between surface reservoir and distributing system for fire and reserve domestic use. Motors are all three-phase, 60-cycle, induction, constant-speed, belt-connected. Combined electric power and pumping plant, hence no costs for power available.

The Ingersoll-Sergeant air compressor is horizontal, single-stage, single-cylinder, with an air receiver seven feet high and three feet in diameter and a 1.25-inch pipe to well.

*Osceola.*—The first pump is an air lift for raising water from deep-well to surface reservoir. The second is a horizontal, duplex, double-acting power pump and forces the water from reservoir into mains.

$3,751 includes cost of air compressor, motor, Deane pump and pipe connection.

*Council Bluffs.*—Pumps are both centrifugal and work between river and sedimentation basins. Motors are three-phase, 60-cycle, constant-speed, direct-connected. Steam pumps force water from sedimentation basins to mains. $1,906 is complete cost, installed.

*Red Oak.*—Pumps are both vertical single-acting, triplex power type and lift from wells to distribution system. At the flat rate of $50 per million gallons, the company furnishes and operates pumps and motors.

*Spencer.*—First pump is a vertical, single-acting power triplex for service between wells and distribution system. The second is a horizontal, duplex, compound, non-condensing steam pump and serves in a similar way only for fire and domestic service. Motor on first pump is three-phase, 60-cycle, induction, constant-speed, belt-connected. This is a combined electric and pumping plant, hence no cost for power available.

*Sheldon.*—The first is a vertical, single-acting triplex power pump for service between wells and distributing system. The second is a horizontal, duplex, compound, non-condensing steam pump, serving as a reserve service between wells and distributing mains. Single-phase, 60-cycle current is used. $3,000 is the entire cost of the installation, including line and building.

*Sac City.*—Two-phase, 60-cycle current is used, the motor being belt-connected. The pump is of the vertical, triplex, single-acting type.

## Electrification Recommended in Boston District.

William B. Bennett, engineer of the Wisconsin Railroad Commission, in a report following investigation of transportation facilities in the Metropolitan District of Boston, makes some comprehensive recommendations for electrification of railroad lines centering in that city, which the Public Service Commission promises to consider with a view to their gradual adoption. The Saugus and Medford branches of the Boston & Maine Railroad, and the West Roxbury branch of the New Haven, besides the Newton Circuit of the Boston & Albany, are subjects for consideration. These lines, steam operated at the present time, it is proposed to reconstruct by the laying of parallel tracks for local trains which would be run from termini of the Boston Elevated Railway's present tunnels and elevated structures. The scheme contemplates the creation of three main routes, intersecting at the center of the branch.

Under the plan proposed by Mr. Bennett, through steam trains might still be operated on the railroads, while local trains, making frequent suburban stops, would perform the suburban service, landing passengers at various points in the city, at present tunnel and subway stations. About $15,000,000 would be required to carry out the plans suggested.

## THE FERRO-ILMENITE ARC ON ALTERNATING-CURRENT CIRCUITS.

By Isador Ladoff.

Andre Blondel demonstrated that the voltaic arc between carbon electrodes is actually being extinguished at the end of each half period, i.e., when the current passes the zero point, and then relighted again.[1] The heat conductivity of carbon is about 37 times poorer than that of the poorest heat conductors among metals. This explains the difference between the behavior of carbon electrodes on one hand and metal electrodes on the other hand on alternating-current circuits. The carbon vapors do not cool down during the passage through the zero point, i.e., do not lose their conductivity to the same degree as the metal vapors do; hence the immense difference in their respective relighting potentials. The relighting potential of carbon electrodes on an alternating-current circuit of 50 cycles and three amperes, for instance, does not exceed 100 volts, but the relighting potential of metal electrodes under identical conditions is almost equal to a static-discharge potential. At higher frequencies, such as produced by discharges of condensers, the relighting potentials of metal electrodes on alternating-current circuits are considerably lower. When the relighting potential is reasonably low, the metal arc is subject to the same loss as the carbon arc.

At constant current the voltage between metal electrodes increases with the length of the arc. On the other hand, when the arc length is constant any increase in current causes a lowering of the voltage in spite of the fact that both the voltage and amperage are periodic functions. This relation between the voltage and amperage may be expressed in straight lines, as was proven by Guey and Monasch. In view of these general facts the experiments recorded here were started with the idea of using an auxiliary arc for the purpose of counteracting the tendency of the metal arc to cool down and lose conductivity on being extinguished at the end of each half period.

The arrangement of two carbon electrodes with one of ferro-ilmenite was tried on a 200-volt, 500-cycle circuit. The arc between one carbon and the ferro-ilmenite electrode formed at once and was maintained without difficulty. The additional carbon was therefore removed.

When 220 volts at 60 cycles was applied directly to the arc with a small amount of variable resistance in series (5 ohms), the arc would only start when the distance between the electrodes would be not more than 0.25 inch and would go out at once.

1 A. Blondel, *La Lumiere Electrique*, 45, p. 551, 1891.

Combinations of carbon and ferro-ilmenite electrodes were tried. When the ferro-ilmenite electrode was placed below, the entire arc was uniformly luminous, due to the ascension of the titanium vapor into the arc stream. The arc was very quiet and the voltage was approximately 120. When there was a restless period, the voltage increased from 120 to 150, and even 300. The familiar crackling sound was then produced.

When the ferro-ilmenite electrode was placed above the carbon electrode, the lower part of the arc was of violet tinge and rather low luminosity, the titanium vapors enveloping the ferro-ilmenite upper electrode. At times a bubble would be formed by the molten slag from the upper electrode and shorten the arc. The arc would turn restless, and try to climb around the highly resistant bubble to the upper rim of the electrode. The voltage would then alternately rise and fall.

A graphite electrode was tried in combination with a ferro-ilmenite electrode, but it was found to be of no advantage.

The circuit finally used had a condenser of 72 microfarads in series with the arc on 2,100 volts.

Power-factor determinations were made with the following results:

| Power-factor | Amperes | Volts | Watts | Length of Arc in Inches | Electrodes |
|---|---|---|---|---|---|
| 62.5 | 2.95 | 92.5 | 170 | 0.75 | Upper carbon; lower metal |
| 68. | 3.2 | 220. | 480 | 0.50 | Both metal |
| 84.5 | 6.8 | 61. | 350 | 0.75 | Both carbon |

The loss therefore appears to be 20 per cent in the case of the system carbon-ferro-ilmenite and 19.3 in the case of both electrodes being ferro-ilmenite.

These tests are the most reasonable of a series including others, but do not appear to be conclusive.

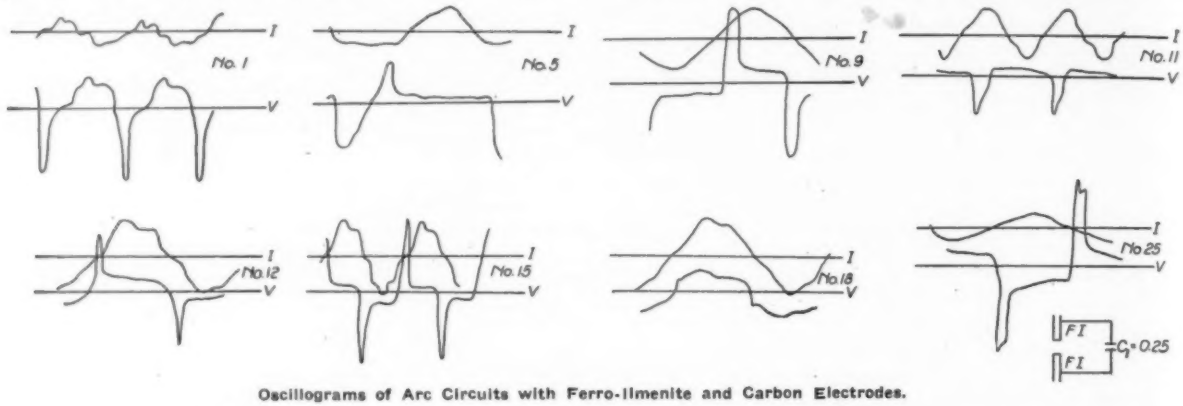
The examination of the oscillograms shows nothing unexpected from the theoretical point of view. The principal and most important fact revealed by these oscillograms is the low average voltage and the reasonably low peaks indicating maximum voltage or relighting potentials. Even if we take into consideration the inertia of the mechanism of the oscillograph and, making allowance for it, assume that the relighting potentials are somewhat higher than indicated, the conclusion seems to force itself that the actual relighting potentials are sufficiently low for commercial circuits.

Another encouraging fact is that the maximum voltages either coincide with or are very near to the zeros of the current curves. The last fact makes it possible to use a modification of Duddell's musical-arc circuit for the purpose of sustaining the alternating ferro-ilmenite arc during the zero point on the current curve by supplying the necessary relighting potentials from the circuit itself. As known, Duddell's circuit is composed of a direct current superimposed upon an alternating current with capacity and induction in parallel and arrangement to disrupt the arc. Our object is to use the capacity and induction in parallel with the alternating ferro-ilmenite arc for the purpose of sustaining the arc.

The condenser-induction system robs the started arc of part of its current. With the decrease of current the potential in the arc grows and reaches its maximum when the current drops to zero. At this moment the condenser-induction system discharges its accumulated energy into the arc and furnishes it with the requisite relighting potential, provided the frequency of the arc is of the proper value. In order to attain this frequency there is only one induction coil that has to be controllable.

DATA FOR OSCILLOGRAMS.

| Oscillogram No. | Upper Electrode | Lower Electrode | Capacity in Microfarads | Resistance in Ohms | Maximum Current | Maximum Voltage | Length of Arc, Inches |
|---|---|---|---|---|---|---|---|
| 1 | Carbon | Ferro-Ilmenite | 4.49 | 0.2 | 8 | 300 | 0.5 |
| 5 | Carbon | Ferro-Ilmenite | 0 | 2 | 7 | 200 | 0.5 |
| 9 | Ferro-Ilmenite | Ferro-Ilmenite | 0 | 2 | 9 | 340 | 0.5 |
| 11 | Ferro-Ilmenite | Carbon | 0 | 2 | 8 | 300 | 0.5 |
| 12 | Ferro-Ilmenite | Carbon | 4.49 | 0.5 | 11 | 240 | 0.5 |
| 15 | Ferro-Ilmenite | Ferro-Ilmenite | 4.49 | 0.5 | 10 | 320 | 0.5 |
| 18 | Carbon | Carbon | 4.49 | 0.5 | 12 | 100 | 0.75 |
| 25 | Ferro-Ilmenite | Ferro-Ilmenite | 4.24 | 3.0 | 4 | 380 | 0.5 |




Oscillograms of Arc Circuits with Ferro-Ilmenite and Carbon Electrodes.

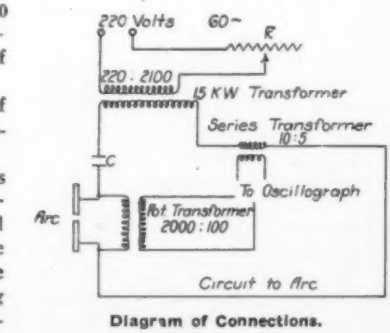



Diagram of Connections.

With this one or a similar arrangement a commercial alternating-current ferro-ilmenite arc may be developed.

Experiments in that direction are bound to bring results.

## Meeting of Society for Electrical Development.

The annual meeting of the Society for Electrical Development, Incorporated, will be held in the Society office, New York City, on Tuesday, May 11, at 10:30 a. m. The annual reports of the general manager and treasurer will be presented and an outline of the work of the Society given by members of the staff. Stereopticon slides and motion pictures will be used to illustrate these talks.

The Board of Directors will hold a meeting after the adjournment of the annual meeting and will elect new members of the Board and Society officers for the ensuing year.

The United States Bureau of Standards, besides its main laboratory at Washington, D. C., maintains two branch laboratories. The Northampton, Pa., laboratory is devoted to the sampling, testing, and certification of cement. The Pittsburgh, Pa., laboratory is devoted to investigations and tests of structural engineering and miscellaneous materials. These include metals, cement, lime, clay and clay products, glass, etc.

## Electroplating With Cobalt.

Among the papers presented at the spring meeting of the American Electrochemical Society was one on "Electroplating With Cobalt," by Herbert T. Kalmus, C. H. Harper and W. L. Savell, of Queen's University, Kingston, Ontario.

The authors made a large number of experiments on the best conditions for the electrodeposition of the metal and reached the following conclusions:

Several cobalt solutions were found to be suitable for electroplating with cobalt under the conditions of commercial practice. Best among these are the following:

*Solution I B:*

Cobalt-ammonium sulphate, $CoSO_4.(NH_4)_2SO_4.6H_2O$, 200 grams to the liter of water, which is equivalent of 145 grams of anhydrous cobalt-ammonium sulphate, $CoSO_4.(NH_4)_2SO_4$, to the liter of water. Specific gravity=1.053 at 15 degrees centigrade.

*Solution XIII B:*

Cobalt sulphate, $CoSO_4$.....312 grams
Sodium chloride, NaCl..... 19.6 grams
Boric acid.....nearly to saturation
Water .....1,000 cubic centimeters

Specific gravity=1.25 at 15 degrees centigrade.

Cobalt plates from these solutions, on brass, iron, steel, copper, tin, German silver, lead and Britannia-metal articles, of different shapes and sizes, deposited under conditions identical with those met with in general nickel-plating practice, are firm, adherent, hard and uniform. They may readily be buffed to a satisfactorily finished surface, having a beautiful luster, which, although brilliantly white, possesses a slightly bluish cast.

The electrical conductivity of these solutions is considerably higher than that of the standard commercial nickel solutions, so that other things being equal, they may be operated at a lower voltage for a given speed of plating.

Solution I B is capable of cobalt plating on the various sizes and shapes of objects met with in commercial practice at a speed at least four times that of the fastest satisfactory nickel solutions.

Solution XIII B is capable of cobalt plating on the various sizes and shapes of objects met with in commercial practice at a speed at least fifteen times as great as that of the fastest satisfactory nickel solutions.

Plates from both of these solutions on various stock pieces satisfactorily withstood the various bending, hammering and burnishing tests to which commercial nickel work is ordinarily submitted.

These two very rapid cobalt solutions are remarkable for their satisfactory throwing power. That is, they readily and satisfactorily deposit the cobalt in the indentations of the work.

These two rapid solutions operate at these high speeds in a perfectly still solution without agitation of any kind.

These solutions are both cleaner, that is freer from creeping salts and precipitated matter, than the standard commercial nickel baths.

The cobalt deposited at this rapid speed is very much harder than the nickel deposited in any commercial nickel bath. Consequently a lesser weight of this hard cobalt deposit will offer the same protective coat as a greater weight of the softer nickel deposit. Considering solution XIII B, operating at 150 amperes per square foot, on automobile parts, brass stampings, etc., a sufficient weight of cobalt to stand the usual commercial tests, including buffing and finishing, is deposited in one minute. With the best nickel baths, it takes one hour, at about 10 amperes per square foot, to deposit a plate equally satisfactory. Therefore, the actual weight of metal on the cobalt plate must be approximately one-quarter that of nickel.

For many purposes, under the condition of these rapid plating solutions, one-quarter the weight of cobalt, as compared with nickel, is required to do the same protective work. Consequently, if nickel is worth 50 cents a pound, in the anode form, cobalt could be worth nearly $2.00 a pound, in the same form, to be on the same basis, weight for weight of metal. In addition there are other advantages of cobalt in saving of labor, time, overhead, etc.

A smaller plating room would handle a given amount of work per day with cobalt than with nickel.

With these very rapid plating solutions, by the use of mechanical devices to handle the work, the time required for plating, as well as the labor costs may be tremendously reduced. Solution I B, and particularly Solution XIII B, are so rapid as to be revolutionary in this respect.

Obviously the cost of supplies, repairs, etc., would be less with cobalt-plating than with nickel-plating, as the size of the plant for a required amount of work is less.

The voltage required for extremely rapid cobalt plating is greater than that for most nickel-plating baths; it is not so great but that the machines at present in use may in general be operated. For the same speed of plating, the cobalt solution requires much the lower voltage.

For a given amount of work the power consumption for this rapid cobalt work is less than that for nickel. This is obvious, because the total amount of metal deposited in the case of cobalt is very much less, whereas the voltage at which it is deposited is not correspondingly greater.

Ornamental work on brass, copper, tin or German silver would require only a one-minute deposit. Even wares exposed to severe atmospheric influences, or friction, could be admirably coated with cobalt in bath XIII B in fifteen minutes. The tremendous possibilities of this solution are not to be completely realized unless mechanical devices are applied to reduce hand labor to a considerable extent.

Thick deposits from these solutions are vastly superior to any that we have seen produced from nickel solutions. The tendency to distort thin cathodes is less pronounced, while electrotypes and electro-dies have been given a superior thick deposit in a most satisfactory manner. The lines were hard, sharp and tough and the surface smooth. Nickel does not equal cobalt for excellence of massive plates.

Many of these tests were passed upon by uninterested skilled mechanics at the plant of the Russell Motor Car Company, who invariably reported in favor of the cobalt as above.

Both baths I B and XIII B are substantially self-sustaining, once they are put into operating condition, and the amount of aging required to do this is very much less for them than that for the present commercial nickel baths.

A number of automobile parts, and a large number of skates, cobalt-plated, were turned out at the plant of the Russell Motor Car Company under Mr. Barrows's direction, and many of the skates have now (February, 6, 1915) been under observation in actual use for several months.

On this date Mr. Barrows reported that skates plated from solution XIII B, many of which had had extremely hard usage in the hands of boys, etc., were showing up with surprising satisfaction.

There is absolutely no stripping of the plate along the edge of the skate, either before or after use, which, unfortunately, is not uncommon with nickel-plated skates. Furthermore, the cobalt-plated skates seem to be decidedly superior to the nickel-plated skates as regards their resistance to corrosion. Another very noticeable feature about the cobalt-plated skates is that they are very free from scratches after rough usage as compared with nickel. That is to say, the cobalt plate is decidedly harder than the nickel plate. Most of the skates in question were plated in three minutes at 90 to 100 amperes per square foot. Nickel plates at the same plant are plated in one hour at about 4 amperes per square foot.

There is apparently considerably more cobalt metal plate on these skates than need be to make them equivalent to nickel-plated skates.

## Geological Survey Station.

The United States Geological Survey opened, on May 1, a district office in Boston, Mass., from which investigation of New England waterpower resources will be carried on. Vermont, New Hampshire, Maine and Massachusetts will cooperate with the government in the investigation. The officer in charge is Charles H. Pierce, district engineer.

## Hydroelectric Power in New England.

"Inventions in the electrical industry have made it possible for one man at the switchboard of a hydroelectric plant to draw more energy from nature's storehouse than could one thousand men a century ago," said Henry I. Harriman, president of the New England Power Company, in a recent lecture before the electrical men of New England attending the General Electric Company dinner in Boston, Mass.

Mr. Harriman held that few sections of the country offer greater possibilities for hydroelectric development and transmission than does New England, in which more than 10 per cent of the total value of manufactured products of the country are produced. Here are five large rivers having a fall of 1,000 to 2,200 feet, besides innumerable streams of less importance, but capable of being utilized to produce electrical energy. It is estimated that it would be theoretically possible to develop in this area of 60,000 square miles, 15,500,000 horsepower for 3,000 hours of each year, this being equivalent to the use of 52 million tons of coal annually.

"The mechanical and engineering problems connected with the development of water power and with the transmission of electricity therefrom, to any distance up to 250 miles may be considered solved," said the speaker. "The question to be settled now is one of commercial feasibility. The generating of electricity may properly be considered a form of manufacturing, water being the raw material, and electricity the resultant product.

"While great difficulties confront the manufacturer of electricity generated from either water or coal, few lines of industry offer greater opportunities, if wisely and conservatively managed. Of all the forms of power, electricity is the most transportable, and within reasonable limits, can be cheaply carried from the place of generation to the place of use. Again, electricity is the most transmutable of all known forms of energy. It can be easily transmuted to the form of lights; it can be changed into the form of the most intense heat for use in the electric furnace; it can be applied to the locomotive to give tractive power; it can be changed into mechanical energy for the turning of the wheels of industry. In fact, no other form of energy can be so easily transmitted from place to place, or so easily applied to useful work.

"Electricity as applied to railway transportation is just beginning to prove its reliability and feasibility." More frequent train service with little added investment is thereby made possible.

The advantage enjoyed by the manufacturer of electricity over his fellows in the exemption from labor troubles was pointed out by Mr. Harriman. A modern hydroelectric plant, he said, does not expend more than 10 per cent of its gross income for wages, while railroads and railways expend about 50 per cent thus, and some industries spend as much as 75 per cent of their gross income in this way.

Costs of construction as compared with steam plants were given. An efficient steam generating plant of large capacity can today be built for between $75 and $100 a kilowatt of installed capacity, while a water-generating plant will cost $100 to $150. Also, the latter may be farther from its market; hence added outlay for transmission system is required. But while the investment may be as much as twice that of the steam plant, depreciation and maintenance are much less. There is practically no depreciation or upkeep for water rights, dam and power house, and water wheels and slow-speed generators depreciate less rapidly than boilers and high-speed turbines.

"It is probably fair to assume," continued Mr. Harriman, "that while the fixed charges (interest, depreciation and maintenance) on a steam plant will be 15 per cent, corresponding expenses in connection with a hydroelectric plant will not exceed 11 per cent. Thus, the fixed charges on a steam plant costing, say, $90 per kilowatt, will be $13.50 per year, whereas the corresponding charges on a hydroelectric plant costing $150 per kilowatt, will be about $16.50, a balance of $3 in favor of the steam plant. The operating expenses of the hydroelectric plant are of course much less than the corresponding costs for the steam plant. One-half mill per kilowatt-hour is a liberal allowance for a large water-power plant, while the corresponding charges of the large steam plant will run from four to ten mills per kilowatt-hour, with varying load-factor, efficiency and station capacity.

"It is stated that one-half the capacity of our central stations is idle 95 per cent of the time. Every station must have a large spare capacity during much of the year. Fortunately, periods of low water occur during summer and early fall when the central-station load is at its minimum. Thus the latter can supply deficiencies of the hydro plant without increase in installed capacity or fixed charges, and in doing so it will increase its load-factor and decrease its unit operating cost. All these facts lead to the conclusion that the large steam plant and the large hydroelectric plant can develop side by side, each caring for the service to which it is best suited, and each giving to the other economies which neither could have alone."

## Central Electric and Former Representative Still at Litigation.

The Supreme Court of the State of Colorado recently handed down a decision affirming the judgment of the District Court in favor of the Central Electric Company, Chicago, in a suit brought by its former representative, John A. Savage, of Denver, Colo., for salary for the month of August, 1910. Savage had previously brought suit in the Denver court to recover his salary for July, 1910, and had obtained judgment. The Central contested the suit for salary for August, 1910 and Judge Whitford found in favor of the Central Electric Company. Savage appealed to the Supreme Court, and the opinion above referred to has just been handed down.

In the meantime Savage brought suit in the County Court for salary for September, 1910, and secured judgment. The testimony covered much the same ground as had been gone over in the suit for the recovery of August, 1910, salary, and although Judge Whitford had decided in favor of the Central in that suit, the suit in the County Court for the September salary was decided in favor of Savage. This case is now pending in the District Court on appeal.

About the time of the decision in the August, 1910, salary suit, the Central Electric Company started three suits in the Denver courts against Savage—one of which was to recover money collected by Savage under the July salary judgment, another to recover all salary paid Savage under his contract, and still another was to recover damages. Subsequently these suits were all dismissed.

Another suit pending upon its own merits and upon counter-claims which have been filed against it, is for damages claimed by the Central. Savage has recently filed amended counter-claims respectively for damages against the Central for breach of contract, claiming that the Central, although accepting and filling orders furnished by Savage and recognizing him as its agent, refused to pay him for services and money expended under contract; a claim for commissions earned under certain contracts between Savage and the Central from May 31, 1906, to May 31, 1909, and an action for damages for libel.

Savage has now made a motion for a rehearing before the Supreme Court of Colorado, on the opinion affirming the judgment of the lower court in favor of the Central, and the latter's attorneys have filed their briefs in answer.

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About one hundred students of Ohio State University took an inspection trip during the week of April 25. They were accompanied by four instructors. The itinerary included two days in Chicago, two days in Milwaukee, one day in Gary and one day in Detroit.

## Commission Report on Water Powers in Massachusetts.

A special commission designated by the Massachusetts Legislature to study water-power conditions in the state has reported its findings. It urges that the state formulate a policy for the control of water sources, pointing out the extensive hydro-electric developments now going forward. A great amount of power is now running to waste that would, if conserved and harnessed, light many towns and cities and operate many factories.

The annual fuel bill of Massachusetts manufacturers is given as about $25,000,000. The full utilization of stream flow would save a large part of this, and also release a vast amount of capital for extensions and new plants.

The report makes it plain that it is undesirable to introduce any stumbling blocks to check the use of private capital in water-power development. The most efficient methods must also be used, so as to enable individuals to create and deliver power at a lower cost than that of steam power which now costs 2.5 per cent less than it cost 10 years ago, despite the advance in the price of coal.

Developed water powers in Massachusetts now aggregate more than 300,000 horsepower. The New England Power Company has the largest, aggregating about 75,000 horsepower. By means of connecting systems of transmission, and auxiliary steam plants, a large part of the state is already served to some extent with water-generated electricity. The report forecasts future use of energy in operating electric car lines in the western part of the state, and says that many cities are looking for easier lighting conditions which electricity generated by water may make available. The rural population also is coming to recognize the value of electric energy in farm operation.

"The equalization of the flow of the waters is the real heart of conservation," the Commission says. "Unless some successful plan is devised for bringing it about, all the hopes of developing water powers except on the larger streams become mere idle dreams."

It is held that there are possibilities throughout the state for the construction of storage basins to impound the waters and equalize stream flow through the year. This work can be done at a moderate cost, the report says. The conservation system employed on the Deerfield River has increased its minimum flow sixfold. It is estimated that 40,000 added horsepower could be gotten from the Connecticut River within the state by a proper system of reservoirs.

The Commission in its conclusion points out the present divided authority by which the control of waters of the state are shared by four or five boards, largely without definite legal powers. An appropriation for engineering studies of conditions is recommended, and is a necessary preliminary to any remedial controlling or conservation legislation. Because of the activities of neighboring states and of the Federal Government, the State of Massachusetts should not delay action.

## An Edison Reminiscence.

Thomas A. Edison as he was years ago employed as an operator at the offices of the Western Union Telegraph Company, in Louisville, was the subject of the talk made to the Louisville Jovians at their recent luncheon meeting held in the Preston Hotel. Charles Smith, district superintendent of the Western Union and once fellow operator and "boss" of Mr. Edison was the speaker, and with him were two or three others who also knew the inventor in his youth and who worked with him. One of them, Charles Weinedel, is now superintendent of the Louisville Home Telephone Company's repair shop.

The consuming absorption of the man in his experiments and investigations was what Mr. Smith dwelt most on. Nobody knew when he slept, and he had lodgings together with several other employees of the Western Union in a house on Jefferson Street, two blocks south of the Western Union headquarters which were then as now at Third and Main Streets. The rest of the others was often disturbed by the experiments Mr. Edison was conducting and he was known frequently to go for several nights without sleep.

His work, although he held up his end of it, seemed always to interfere with his investigations and he sometimes brought automatic devices to the office to take care of certain of his routine duties. One of these was a wheel operated by a coiled spring and governed by clock work. The rim of the wheel was studded with contact points which as the wheel revolved made the dots and dashes that spelled out a service message which had to be handled at a certain hour every day. All that was necessary to perform this task was done by keeping hands off and this gave the inventor relief from interruption.

Concentrated application such as his was bound to accumulate a nervous tension that had to find relief and the young inventor's way was to tell, at intervals of several days, a funny story at which he was wont to laugh most heartily, then to return to his work prepared for another four or five days of application with no danger of a joke. These stories were extremely laborious, Mr. Smith recalled, and the other men in the office used to groan whenever the inventor began one. In time they got to leaving as speedily as possible, but their departure never troubled the inventor, who finished the yarn, had his laugh and returned to his researches.

He was as unconcerned about all other outward things, apparently, as of the way his friends treated his jokes. Food was the least of his troubles, weather was all alike to him, he was always utterly absorbed. The men who worked with him were very much impressed with his earnestness and those who are living have followed his rise with pride.

## What the War Is Costing.

J. Annan Bryce, member of the British Parliament and chairman of the British Westinghouse Electric and Manufacturing Company, recently referred as follows to the cost of the war and its possible effects upon industry:

"It is expected by most people that a great depression in trade will follow the close of the war. The expenditure of the present belligerents alone cannot, if the war lasts only eighteen months, fall much short of 25,000 million dollars. Add to this the expenditure by neutrals due to the war, say another 500 million dollars, the destruction of property, certainly at least another 5,000 million dollars, the loss by non-creation of wealth from the labor of at least 12,000,000 fighting men for eighteen months at the low estimate of $250 per man, another 3,000 million dollars, and the permanent loss by non-creation of wealth say for four years from the death or disablement of say 4,000,000 of fighting men, another 5,000 million dollars, you get the appalling total of capital loss of 40,000 million dollars. And this vast sum does not include anything for the diminished production of wealth caused by the diversion of immense bodies of labor not only in the belligerent but in many neutral countries, from the production of wealth to the production of unproductive war supplies, or for the consequent disorganization of industry. Nor does it include anything for the incalculable diminution in production, which must follow from the death or enfeeblement by famine and disease of huge numbers of human beings in the war areas. It will certainly take the world a generation to recover, and its purchasing power must be vastly lessened in the immediate future.

"But it does not follow that all industries will be equally affected. Those which are, like our own, concerned with the provision of more economical means of production and transport may even benefit, especially considering that so extensive a destruction of the older types of mechanical production may furnish an opportunity of reconstruction on modern lines."

## LETTERS TO THE EDITOR.

### Inspection in Small Towns.

*To the Editor:*

The condition complained of by E. M. Raetz in your edition of April 24, 1915, is explained as follows:

The insurance inspector is not backed up by the law when he condemns a bad case of wiring and his only way out of the dilemma is to tax the owner a certain extra sum on the rate on his building. Insurance inspectors have only one standard for new work and that is the National Electrical Code rules. Where a complete town inspection takes place it is not done with the object of making defective wiring measure up to standard requirements, but rather to eliminate only such defects which constitute a fire hazard.

It is just possible that the cases he has in mind have not been brought to the attention of the inspection bureau of the insurance company, or the insured is paying for the defective wiring in an increased insurance rate.

The remedy: Either have the local council of Rochester, Minn., adopt a suitable ordinance regulating the use and installation of electricity and electrical equipment, requiring National Electrical Code standard construction, or have all such work done subject to the inspection and approval of the insurance inspection bureau in Minnesota.

W. A. GIBSON.

Detroit, Mich., April 29, 1915.

*To the Editor:*

Replying to the inquiry in the Letter to the Editor contained on page 783 of your issue of April 24, 1915, would say that technically Mr. E. M. Raetz, of Rochester, Minn., is correct when he states that an identical electrical job, if defective, should be regarded as unsafe in a small town the same as in a large one, but the practicability of insurance companies giving both jobs equal attention is quite another matter. Mr. Raetz will readily realize that as a rule a great deal more property is jeopardized by a defective equipment in the congested districts of large cities than is the case when located in a small town. Therefore, the insurance companies can afford to give such a defect more attention in a large city because there is more property at risk and because the premiums are larger and therefore admit of greater expenditures for inspection.

Your correspondent should be made to realize that the safety of the community from fire dangers due to defective electrical equipment should not be placed solely in the hands of insurance companies and that the people themselves, through their organized governing units, should take cognizance of the matter and by the establishment of municipal supervision, eliminate the dangerous practices.

In view of the fact that in the case of the average small city, a competent inspector is not always available, the State should establish a Department of Electrical Inspection for service in the small cities, so that it would be possible for any small town desiring electrical inspection service, to make an arrangement with the State Department of Electrical Inspection for the services of an electrical inspector for a certain number of days per week to regulate the hazard within the borders of that community. The municipality creates a responsibility in this matter when it permits a public service company to operate in the city to supply electric current to its citizens and its responsibility includes the safeguarding of the lives as well as the property of its people.

WILLIAM S. BOYD.

Chicago, Ill., April 30, 1915.

## Electric Delivery in Merchandising.

The comprehensive delivery system of Marshall Field and Company, Chicago, was described in a talk before the Chicago Section, Electric Vehicle Association of America, on May 4, by Fred J. Pearson, electrical engineer of the company. Mr. Pearson stated that there are at present 226 electric, and 75 gas power wagons used by Marshall Field and Company, which deliver in a territory of 450 square miles, and cover a total distance of 8,400 miles per day. The average mileage of the electric vehicles is 28 to 30 miles per day, although some of the lighter electrics travel as far as 40 miles in one day. Mr. Pearson stated that to do the same work, from 850 to 900 horses would be required.

The advantages of motor delivery service, such as promptness, cleanliness, etc., were commented upon, and various features in connection with the garaging of the cars were described. One of the particular advantages of the motor-propelled vehicle is its space economy in loading, unloading at platforms, and in turning. The company has a series of distributing stations located at convenient points throughout the city, from which small packages are delivered by electric wagons. These packages are transported from the store to the distributing stations in trunks, by means of gasoline trucks. The radius of the light electric package delivery wagon is about five miles.

Energy for the operation of the electric vehicles is purchased from the Commonwealth Edison Company, and careful records are kept of the performance of each car. Individual watt-hour meters are located on every charging circuit, and battery performance is carefully noted. Mr. Pearson stated that the company is very much pleased with the service given by the electrics, and would not consider any other method of transportation.

## BOOK REVIEWS.

"Constant-Voltage Transmission." By Herbert Bristol Dwight. New York: John Wiley & Sons, Inc. Cloth, 115 pages (4¾x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.25.

This book is a discussion of the use of synchronous motors for eliminating the variation in voltage in electric power systems. While parts of the subject are analyzed mathematically, the book is nevertheless readable for those who do not care to take up this mathematical analysis. The problems arising upon high-tension networks are discussed and the suitability of the synchronous motor in regulating the voltage is fully explained. The author believes that this method of regulation could well be used much more widely than it is at present and in addition to securing better voltage conditions, the power capacity of most lines would be greatly increased. Cost comparisons are given, and there are a number of tables covering the conditions for both long and short lines. A commendable feature is the summary given at the end of a number of the chapters of the matter contained in that chapter.

"Oxy-Acetylene Welding and Cutting." By Calvin F. Swingle. Chicago: Frederick J. Drake & Company. Cloth and leather, 190 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.50 in leather or $1.00 in cloth.

The author of this book is evidently an enthusiast for oxy-acetylene welding, and he makes a good presentation of the subject. There is a brief comparison with other methods of welding, in which acetylene is easily shown superior, but curiously enough electric welding is not included in the comparison. The chemistry and physics of acetylene, its generation and application, are first given. Then follows a description of the apparatus used in welding, and directions for its use, which are quite practical. The final chapter deals with the removal of carbon from gas-engine cylinders by the use of oxygen. The book is well written and printed, but some of the illustrations are rather crude. For its scope, it should excellently serve in giving the essential practical points of the oxy-acetylene method of welding.

## Wireless at University of Pittsburgh.

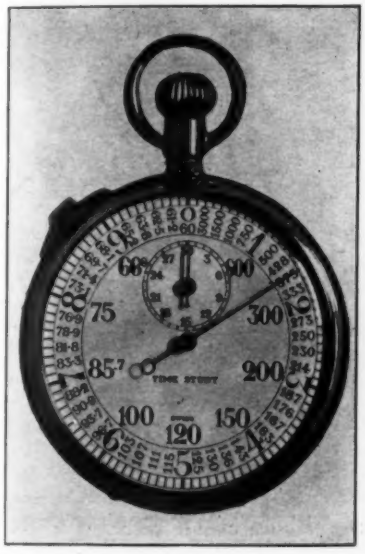
The University of Pittsburgh has recently completed a wireless telegraph plant, and will co-operate with the high schools of the district in its use. An organization known as the Radio Society of Western Pennsylvania has been formed and will hold regular monthly meetings at the University. A series of lectures by Dr. Powers has been planned.

# New Electrical and Mechanical Appliances

## The Time-Study Watch.

The modern management of shops finds frequent need for the use of a stop watch in determining the time necessary for the different operations involved in the manufacturing process. When an ordinary stop watch is used to determine the time of an operation, an arithmetical calculation is necessary to translate this into terms of output per hour or per day. The time-study watch, shown in the accompanying illustration, has been devised to eliminate this computation and enable the observer to read directly from the dial the quantity desired.

In order to accomplish this purpose, the circumference of the dial is divided into 100 parts, as in the well known decimal dial, but instead of these divisions being numbered in the ordinary way, they are marked with figures which indicate the number of operations made per hour, when the time of a single operation is represented by the elapsed time. Thus, in the illustration, the second hand is on the sixteenth division, representing 0.16 minute as the time of a single operation. In this case 375 operations can be made per hour, and the division is consequently numbered 375. The convenience of this can only be appreciated by one who has used the watch. In the case of very short operations, 10 operations instead of one can be timed, and the figure read off the dial is then multiplied by ten.




Time-Study Stop Watch.

This watch contains another feature which is very useful. Time can be taken out in case of the interruption of the operation. By pushing the slide on the side of the case, the hand is stopped, while reversing the position of this slide starts it again. To bring the hands back to zero, the crown is given a push.

A similar dial can be provided without the latter feature when this is desired.

The exclusive selling rights for this watch are held by Mortimer J. Silberberg, 755 Peoples Gas Building, Chicago, Ill.

## Indicating Heater Receptacle.

For use with flatirons, soldering irons and other electrical appliances, particularly of the heating or cooking type, it is very desirable to provide a convenient and reliable means of indicating when the circuit to the appliance is closed. This is for the purpose of preventing waste of current when the operator is called away from the use of the appliance and also to prevent possible hazards in case the heating appliance is left turned on for an indefinite time in the absence of operator or attendant.

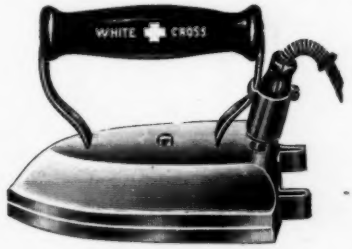
Indicating Heater Receptacle and Switch.

A convenient device which exactly meets these requirements and which has combined in it a plug receptacle, pilot lamp and switch, has been placed on the market by the firm of Harvey Hubbell, Incorporated, Bridgeport, Conn. The indicator is a small lamp mounted behind a red bull's eye; this takes but a very small current, but indicates at all times when the circuit to the appliance is closed. The switch is of the flush, push-button, wall type. The receptacle is provided with the new Hubbell T-slot contacts which permit interchangeable use of 17 different types of caps.

This device is rated at 10 amperes, 125 volts, which gives a good idea of the liberal dimensions of its electrical parts. It is designed for use with three-gang wall boxes. The four supporting screw holes are spaced so as to hold the face plate rigidly.

## White Cross Flatiron.

A new type of electric flatiron has been placed on the market by the Lindstrom, Smith Company, 1102 South Wabash Avenue, Chicago, Ill. This is an addition to the company's line of White Cross electrical devices. This iron is sturdily built. The body comprises but three parts: the bottom plate or ironing surface, the heating element, and the superposed main body or cover. The construction is such as to confine practically all of the heat to the ironing surface, very little being dissipated by radiation from the top or sides. The heat is intensified at the point and edges of the ironing surface where it is most needed. The heating element is easily removed and can be replaced if damaged without the necessity of sending the complete outfit to a repair shop or back to the factory. The iron is given a high-grade finish, and makes a pleasing appearance.




New Electric Flatiron.

These irons are made for any voltage up to 250 volts. The most common weight is six pounds; such an iron takes only 400 watts, thus being economical in operation as well as low in first cost.

## Novel Automobile Ignition Lock.

The Connecticut Telephone & Electric Company, Meriden, Conn., has just placed on the market a new type of lock as applied to its automatic switch controlling the Connecticut automatic igniter system. This lock is different from the ordinary ignition lock inasmuch as the key is required only to unlock it, the switch being locked by means of a small plunger directly over the right-hand button. With this arrangement, it is possible to carry the ignition key in a bunch on the regular key ring, as it is not nec-

Ignition Switch Lock.

essary to leave it in the lock when the car is being used. In order to operate the locking feature, it is simply necessary to press the small button after the switch button has been released and the ignition shut off.

It is so designed that it is not possible to lock the ignition until it has been thrown off. The lock is very simple in construction and foolproof. The keys are not interchangeable, as is the case with most ignition locks, which is a decided advantage as it is not possible to unlock it with one common key, a feature that largely destroys the effectiveness of a lock of this nature.

## A Four-Inch Electric Fan That Can be Carried in the Grip.

Traveling men and theatrical people are frequently compelled to stop at small inns in which the facilities are not of the highest class. Consequently a room must frequently be occupied which is warm and uncomfortable. If the traveling man could carry about with him a very small fan that could be connected to any common lighting socket, it would be the means of providing him with much comfort.

Racine "One-Man" Fan.

Realizing the possibilities of such a device, there has been developed and placed on the market by the Racine Electric Company, Racine, Wis., a compact, lightweight fan which seems to meet the requirements exactly. This fan weighs but 2.5 pounds, and has blades four inches in diameter. Its maximum dimension in any direction is four inches, thus it can be easily put into a grip without inconvenience. The motor is of the universal type, which can be used on direct current or alternating-current circuits varying in voltage from 110 to 130 volts.

A cord and attachment plug are included with the fan, which is well built in every particular. A speed regulator provides means for adjusting the amount of breeze to meet the exact requirements. Because it is designed to provide breeze for just one person, the outfit is called the "Racine One-Man Fan." It has been used however, to great advantage by actresses and other traveling women with as much success as by the traveling men. It is also useful in small offices, such as for ticket sellers, and in other confined places where a small fan of this type is the only means of affording comfort and efficiency.

## Atwood Stationary Vacuum Cleaner Outfit.

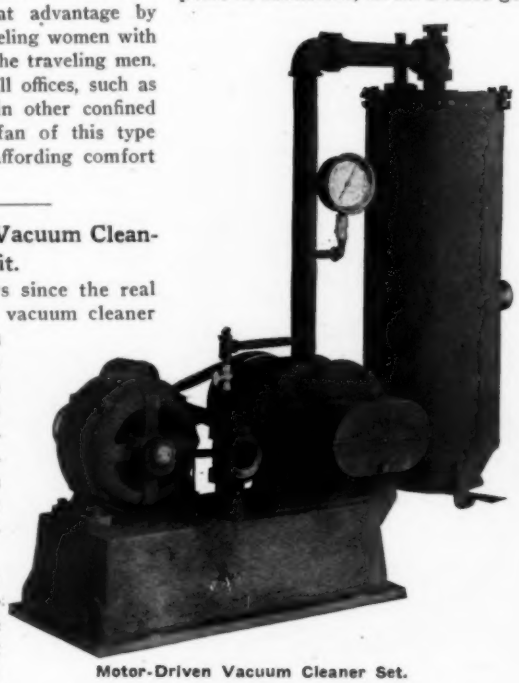
It is not many years since the real economic value of the vacuum cleaner as an agent of sanitation and a labor saver was first recognized. Since its introduction it has been developed and commercialized to such a remarkable degree it is now regarded almost universally as a household necessity.

The cleaner shown in the illustration is suitable for the average residence or apartment buildings. It represents the latest development of the Atwood Vacuum Cleaner Company and, while embodying many improvements, the principle of operation is the same as that of the Atwood cleaners which have met with such marked success during the seven years that they have been on the market.

The vacuum is obtained by a motor-driven exhauster operating on the principle of the two-shaft positive blower. It consists of two shafts, each carrying an impeller similar to a two-toothed gear. These impellers turn in opposite directions and operate with a very slight clearance on all sides which is sealed by water drawn from and afterwards returned to a reservoir in the base. The bearings have unusually large wearing surfaces. The two bearings on each side are set in a large oil chamber which permits easy inspection upon lifting a hinged cover.

A Westinghouse electric motor is belted to the exhauster. The one shown in the illustration is a one-half-horsepower alternating-current machine and is fitted with a clutch similar to the multiple-disk type used on many well known automobiles.

An ingenious combination of a tank and a canvas bag insures the removal from the air of all dirt. The air passes first into a tank where the larger particles are removed by gravity and then through a canvas bag which removes the finer dust. After passing through the exhauster, the air is discharged through a pipe which can be run to the outside of the building or into a chimney. This is important from the standpoint of sanitation, as all disease germs are thus carried to the outside of the building instead of being allowed to escape back into the room.



Motor-Driven Vacuum Cleaner Set.

## Outdoor and Indoor Electric Signs with Interchangeable Displays.

A line of electric signs with interchangeable display matter has been placed on the market by the Northwestern Electric Works, Corn Exchange Building, Minneapolis, Minn. These signs have a number of distinctive features. The framework is entirely of metal and the faces are arranged to receive interchangeable glass letter or picture plates.

In the case of outdoor signs the frame is made of No. 24 gauge metal neatly

Fig. 1.—Interchangeable Outdoor Electric Sign.

finished and protected from corrosion. The frame is in the form of a hollow box 4.75 inches thick; the over-all height of the sign is 26 inches; the total length averages one foot times the number of unit spaces for letters, emblems, trademarks or pictures. The letters or illustrated plates are each 12 inches high and made of double strength glass. Letter plates have a dark background with the letter body made brightly translucent and outlined with gold. The specially illustrated plates are usually placed at one or both ends. These illustrated plates are attractively colored with durable translucent colors by means of a special process; they make a strikingly effective appearance both by day and night. Letter or picture plates can be changed in a few minutes. The two sides of the side may bear the same or different displays, as desired.

A good idea of these outdoor signs can be had from Figs. 1, 2 and 5. Fig. 2 in particular shows the construction and how readily glass plates may be changed. One 25-watt Mazda tungsten lamp is used between each pair of spaces. The energy consumption of the signs is consequently very small and is further reduced if a flasher is used. The signs are shipped complete with lamps and hanging gear, so as to be ready to hang up and connect to the circuit.

For indoor use, particularly in store windows, another type of interchangeable electric sign is made by the Northwestern Electric Works. These signs are made in two lengths, 28 and 37 inches. The letters are gold-outlined and 4.5 inches high; they are readily changed by inserting in the removable sliding front. The arrangement is shown in Fig. 3, in which the front has been partly pulled out, exposing one of the lamps in the interior. In the shorter signs two lamps are used and in the longer ones three lamps. The former signs are furnished with 60 interchangeable letters and the latter 75.

Each sign is provided with two illustrated colored slides that the purchaser can select from a large assortment of stock slides to suit a great variety of stores. Fig. 4 shows a larger view of one end of such a sign with appropriate picture for a sporting-goods store handling "quality" products. Special illustrated slides can be prepared to order. These slides are very neatly colored and add greatly to the attracting power of the sign. Each of these signs is provided with a simple adjustable flasher of the motorless type. They are shipped ready to connect to any lighting outlet. These indoor signs are known as Mazda flash signs.

Both the outdoor and indoor signs are low in first cost and very economical in operation. Although on the market only about a year, they have evidently met a decided demand and have been installed in nearly all parts of the country. Many merchants secure the co-operation of jobbers or manufacturers in featuring special products by means of the pictorial plates or slides. These signs are well constructed and have been approved.

Fig. 2.—View Showing Interior Construction of Sign and Interchangeability of Display Plates.

Fig. 3.—Indoor Sign with Front Pulled Out to Show Interior Construction and Interchangeability of Letters.

Fig. 4.—Enlarged View of One End of Indoor Sign.

Fig. 5.—Outdoor Sign with Pictorial End Plate.

## Italian Pit-Mouth Electric Plant.

A large plant which utilizes the poorest coal and waste for furnishing electric power and light has been erected at the mouth of a lignite coal mine at Castiglia, Province of Arezzo, Italy. The plant is well and economically arranged and is equipped with the most modern machinery. In addition to utilizing this current for mining operations, it is transmitted to Valdarno, Florence, and Siena, furnishing light and power to these towns, and a branch is being built to Arezzo. The amount of power used for the machinery of the mining operations is small. The coal is very soft.

## High-Frequency Oscillator for Porcelain-Insulator Testing.

One of the recent developments of the laboratories of the General Electric Company and now commercially available is the 125,000-volt, portable, high-frequency oscillator—an outfit designed for the purpose of testing porcelain, high-tension line insulators and bushings by means of high-frequency, high-potential current. This equipment is built for operation on 25, 40, 50 and 60-cycle circuits, and may be connected for 110 or 220 volts. It requires about 1.5 kilovolt-amperes at 25 cycles, 2 kilovolt-amperes at 40 cycles, and 2.5 kilovolt-amperes at 60 cycles, and will deliver current having frequencies of approximately 300,000 cycles at voltages up to about 165,000 volts.

In addition to the 125,000-volt set, to which this description applies, a 250,000-volt set for testing large porcelain parts can be furnished. A 500,000-volt set is under construction. A small 100,000-volt set designed to test a single insulator and to meet exacting requirements of portability will shortly be available. Although this last set does not have all the refinements of the larger sets, it should be very well suited for testing insulators on a line and for rough testing of stocks of new insulators ready to be in service.

The usual high-potential test of apparatus is to apply twice its rated voltage at 60 cycles for one minute.

It can be said, however, that insulators successfully passing this test never fail in practice due to 60-cycle potential; but they are damaged electrically by lightning, by heavy surges from switching, by heavy surges from arcing grounds and similar causes, where high frequency is always present and there is a menacing rise in potential. It would seem, therefore, in order to safeguard against all such natural hazards and assure a greater factor of safety against failures of insulators, that they should undergo the high-frequency test.

Sixty-cycle voltage has very little corona effect on most insulators. The discharge is accompanied by a single spark, which either punctures the porcelain or creeps around the skirt surfaces. The probable tripping of the circuit-breaker, as a result of this sudden spark, necessitates bringing up the potential again until the second discharge takes place. This test, consequently, leaves unstressed many portions of the porcelain that would otherwise be stressed and affected by transmission-line surges.

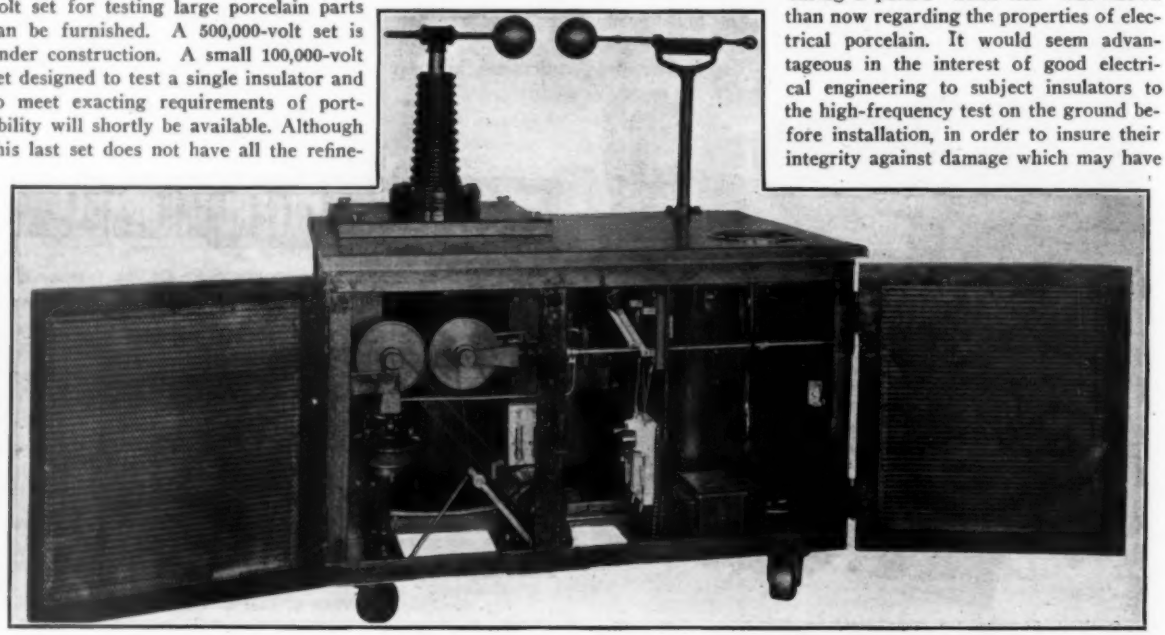
In contradistinction, when high frequency is applied to an insulator, the whole insulator is bathed in a visible and audible corona, which clings more closely to the surface and searches more thoroughly for flaws and can be extended almost to the edge of the skirts before a spark discharge takes place. This spark then extinguishes itself and relieves the stress in that particular location, whereupon a new spark is formed elsewhere on the insulator surface; 120 sparks per second can thus be produced, which is equivalent to 120 separate tests with a 60-cycle outfit.

The heating effect is negligible. Corona may play on the surface of the porcelain over periods of several minutes without heating it up more than a few degrees, hardly perceptible to the touch. The heating effect from sparks is naturally greater, but nothing serious—a rise of only a few degrees. During heavy discharges, concentration of a fixed spark can be avoided by changing the conditions of the test so that the discharge takes a new path around the insulator at each successive impulse. The appearance to the eye should be that of many radial streaks of discharge fairly uniformly distributed over the whole surface of the insulator.

Experimentation has revealed some interesting and significant information on the efficacy of high-frequency tests. Among 1,000 porcelain parts of different types tested by each method, no failure by the 60-cycle test was noted on any part that had undergone the high-frequency test. On the contrary, there was an average of 8 per cent of failures as the result of the application of high frequency after the insulators had successfully withstood the 60-cycle test, indicating that high frequency furnishes a more exacting test.

These tests may prove very illuminative in point of existing practice in design. It should be remembered that most insulators now in service were installed during a period when less was known than now regarding the properties of electrical porcelain. It would seem advantageous in the interest of good electrical engineering to subject insulators to the high-frequency test on the ground before installation, in order to insure their integrity against damage which may have resulted from handlng or transportation.

High-frequency tests at manufacturers' plants, aside from eliminating insulators unfit for all natural hazards of service, should prove valuable in determining the uniformity of vitrification, and the proper proportion of thickness to length in different parts of the porcelain. Faulty insulators may be due to accidents of manufacture, such as foreign matter in the wet porcelain, which may burn out during the firing process and leave air ducts. Unequal contractions in drying may result from lack of uniformity and leave imperceptible cracks. Underfiring leaves porcelain in a porous condition and weak in dielectric strength. Improper proportioning may result in overstressing more perfect parts, thereby resulting in puncture before the arc can



High-Frequency Oscillator for Porcelain-Insulator Testing Up to 125,000 Volts.

move around the skirts. Absolute uniformity in porcelain is practically unobtainable. When subjected to extreme strains, the weakest parts naturally fail first, although such parts may be strong enough for ordinary operating conditions.

The function of the high-frequency oscillator test is thus to approximate more nearly the very conditions under which insulators do fail in service, i. e., lightning surges, switching surges, arcing grounds, etc. Lightning comes in multiple strokes of extremely rapid succession, so rapid as to appear usually as one stroke. Switching surges are of comparatively short duration. Arcing-ground surges may last several seconds, or even minutes. The frequency will be high in every case, and there will also be a rise in voltage. With lightning, there is no limit to the potential except that which will cause a discharge from line to ground. With switching surges and arcing-ground surges, the potential nearly always reaches double value, and may even exceed very much that value.

It has been contended that the high-frequency test might be dangerous to porcelain. The object of this test is to be dangerous to electrically imperfect porcelain. Experience has proved that it is not harmful to good porcelain, providing the insulators are properly proportioned and constructed and the electric strain is not carried unreasonably too close to maximum limits. The duration and intensity of tests should be governed by the stresses insulators are expected to stand in service. Insulators that fail under such tests would fail under similar stresses in service. In the laboratory, good insulators have withstood high-frequency tests by the hour, which demonstrates that good porcelain is not injured and that only imperfect material is picked out by the high-frequency test. Puncture is immediately evident from the cessation of the voluminous corona playing on the surface.

The high-frequency oscillator is designed for testing porcelain insulators only. It is best adapted to testing at the factory, laboratory or at some point on a transmission system where insulators are delivered or tested. The number of insulators that can be tested in multiple depends on the type of insulator. Five suspension-type insulators can be tested in multiple at a test voltage of 80,000 and frequency of 300,000 cycles per second.

Where transportation conditions permit, the oscillator can also be used to test suspension insulators in place on the line and pick out defective ones, providing the spark potential of the individual disk is not greater than the voltage rating of the oscillator (125,000 volts.) Under the same conditions the oscillator can be used to test any pin insulator, providing it is mounted on a dry wooden crossarm, or is mounted on a metal crossarm that is carried on a dry wooden pole and is not connected to a ground wire.

The essential elements of the high-frequency oscillator are: A step-up transformer, 110 or 220 to 13,000 volts; a condenser placed across the terminals of the high-voltage coils of this transformer; an adustable control gap; an oscillation transformer, oil-immersed, with no iron core, consisting of a few turns on the primary and many turns on the secondary; a properly proportioned sphere gap; a suitable reactance to protect the step-up transformer against the damaging effect of short-circuit when a spark takes place at the control gap.

The oscillating current transformer consists of two concentric windings arranged vertically in a stoneware jar and immersed in oil. They are connected together at one end and grounded, the outer coil consisting of a few turns of copper strip wound on a form of treated wood. The ends of the coil are brought

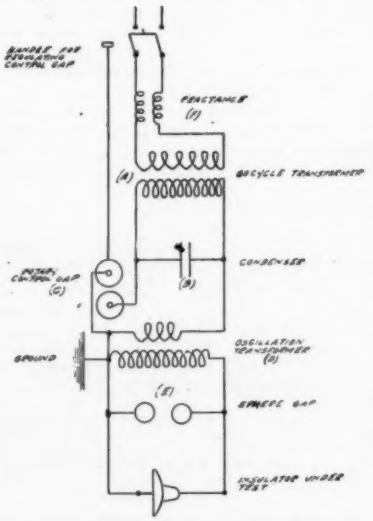



**Diagram of Connections of High-Frequency Oscillator.**

out through the stoneware jar under the oil, and are connected to the condenser and spark gap. The condenser, as stated, is charged by the 13,000-volt supply transformer. The apparatus is supported in an angle-iron frame mounted on casters and inclosed on all sides with perforated iron, with doors at the front. A wooden cover is placed on top, and supports the sphere gap.

The voltage is controlled by gradually opening the control gap, one electrode being grounded and connected to a rod extending through the side of the case, which permits manipulation while the arc is playing across the gap. The high-frequency, high-potential across the sphere gap is read directly in volts off a graduated scale provided with the outfit. The fuses and disconnecting switches are mounted inside the frame, the main switch being connected by a rod to a handle just above the control gap handle. These two handles represent the entire control of the apparatus, the element of the duration of test desired being readily governed by the switch handle.

The electrical operation is interesting. Current at 110 or 220 volts is received at the low-tension side of the step-up supply transformer. The voltage across the high-tension side is then limited by setting the control gap ,which is in series with the high-tension circuit of this transformer. As the voltage across the control gap increases, the condenser becomes charged; when there is sufficient voltage to spark across the control gap, the charged condenser becomes short-circuited, and a current surges back and forth through the circuit containing the condenser, the control gap and the low-tension side of the oscillating transformer.

This is a damped oscillation, and occurs always when a charged condenser is discharged through a circuit containing inductance and resistance. The oscillation is communicated to the high-tension coil, which is wound in a single layer. Forced oscillations are used in the oscillator, which distinguishes it from a wireless outfit. In the latter, resonance is used, and therefore it is necessary to adjust the inductance for every new condition, to arrive at the proper natural frequency, before power can be obtained. By using forced oscillations, the oscillator needs no adjustments for changes of natural frequency.

The real function of the charged condenser is to give additional energy and power to the discharge spark, inasmuch as it is quite possible for the control gap to arc over without the condenser. The oscillating transformer proper thus merely steps up the high-frequency voltage to the test values desired at the sphere gap. An air core is employed, as iron cannot be used with such high frequencies, and this transformer is immersed in oil to increase the insulation of the winding. A discharge takes place for every alteration of the generator wave. A 60-cycle generator thus gives 7,200 discharges of high frequency per minute.

## Strong Magnetic Fields.

An electromagnet constructed by Deslandres and Perot, and described in a communication to the French Physical Society last year, produced a magnetic field of 41,000 gausses in an air gap 2.1 millimeters long, and 3 millimeters in diameter, with pole pieces of iron. The exciting current was 24 amperes in this case. The maximum field obtained was 51,500 gausses, utilizing 30,800 ampere-turns.

With special pole pieces of cobalt-steel, a field of 50,500 gausses was produced in an air gap 1.7 millimeters long, and 3 millimeters in diameter.

# Latest Approved Fittings

**ATTACHMENT PLUGS, Fuseless. — Harvey Hubbell, Incorporated,** Bridgeport, Conn.

Signal attachment plug.

A special base carries contacts for "Hubbell" attachment plugs and receptacles, terminals for a flexible cord, and a socket and wire lamp guard for a candelabra lamp in parallel with device supplied through cord. 10 amperes, 125 volts, catalog No. 6109.

Note.—A lamp in parallel with a portable appliance is judged to be of some value as an indicator, but its value for this purpose is somewhat lessened by the fact that no means is provided to ensure reliability of indication since removal or breakage of lamp does not make it impossible to use portable device or to leave it connecfed to supply circuit.

Listed March 9, 1915.

**CINEMATOGRAPH PROJECTOR.—The Pathescope Company of America,** 33 West Forty-second Street, New York, N. Y., submittor. Manufactured by Compagnie Generale d'Establishments Pathe Freres, Vincennes, France.

Popular model "Pathescope," a portable motion-picture machine having for its illuminating element a 12-volt lamp in series with a current-limiting rheostat and provided with necessary portable cord and attachment plugs for use on ordinary lighting circuits. Rating 2 amperes, 120 volts.

Standard for use only with slow-burning films supplied by manufacturer.

Listed April 13, 1915.

**CONDUIT BOXES, Supports for. —D. C. Overbagh,** 710 Jackson Boulevard, Chicago, Ill. M. B. Austin and Company, sole sales agents, 710 Jackson Boulevard, Chicago, Ill.

"D. C. O."

Supports consist of formed slotted steel bars with holes for mounting, steel-tongued hickeys with three-eighth-inch pipe threads and one-quarter-inch steel screw and nut. Boxes are secured on hickeys clamped against bar. Designed for mounting conduit boxes, on joists, etc., in ceilings, and hollow walls.

Listed April 20, 1915.

**FIXTURE WIRE.—The Goodyear Rubber Insulating Company,** 105 East 131st Street, New York, N. Y.

Marking: Two green and one red threads laid parallel to wire, between rubber insulation and braid.

Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed April 9, 1915.

**HEATERS, Electric.—The Caloric Company,** Janesville, Wis.

**The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.**

"Caloric" automatic electric fireless cookstove.

This device consists of a heating element under a boiler, both packed in mineral wool and inclosed in a sheet-metal box. A switch mounted in cover is operated by movement of a valve whose motion is actuated by pressure of steam generated in boiler.

Listed April 20, 1915.

**LIGHTNING RODS. — Cole Brothers Lightning Rod Company,** 316 South Seventh Street, St. Louis, Mo.

Labeled.

Listed April 20, 1915.

**LIGHTNING RODS. — Electra Lightning Rod Company,** 167 West Washington Street, Chicago, Ill.

Labeled.

Listed April 20, 1915.

**RECEPTACLES, Standard. — The Bryant Electric Company,** Bridgeport, Conn.

"Bryant" or "Perkins" metal-shell, closed or slotted bases.

Pull, 250 watts, 250 volts. For use on metal ceilings, catalog Nos. 4104, 4105.

Also above types with shadeholders attached.

Listed April 3, 1915.

**RECEPTACLES, Standard. — The Electrical Manufacturing Company,** 1951 Lawrence Street, Denver, Colo.

E. M. Co.

Keyless, 660 watts, 250 volts.

Concealed, catalog Nos. 1815, 1816.

Cleat, catalog Nos. 1817, 1818.

Listed March 22, 1915.

**SOCKETS, Standard, Insulating Sinks for.—The Bryant Electric Company,** Bridgeport, Conn.

Detachable insulating link for sockets and receptacle chains, catalog No. 513.

When used on pull-chain sockets or receptacles in manner intended, this insulating link is judged to afford to a person operating socket a desirable added protection against shock from circuits of voltages of not over 600 volts.

Listed April 9, 1915.

**SWITCHES, Combination Cutout.—Detroit Fuse and Manufacturing Company,** 1400 Rivard Street, Detroit, Mich.

Square D inclosed combination cut-out switches.

O-200 amperes, all standard voltages.

Catalog Nos. 5211-E, 5251-X, 5311-E, 5311-X.

Service switches and distributing cabinets.

O-30 amperes, 125 and 250 volts, catalog Nos. 2000, 2002, 2003, 2011, 2012, 2013, 2051, 2052, 2053.

Listed April 8, 1915.

**SWITCHES, Combination Cutout. —Detroit Fuse and Manufacturing Company,** 1400 Rivard Street, Detroit, Mich.

Sealable service switches, 30 amperes, 125 volts, catalog Nos. 4211-E, 4311-E, 4211-O, 4311-O.

Listed April 10, 1915.

**SWITCHES, Combination Cutout. —Detroit Fuse and Manufacturing Company,** Walker Power Building, Walkerville, Ontario, Can.

Square D inclosed combination cut-out switches.

O-200 amperes, all standard voltages.

Catalog Nos. 5211-E, 5251-X, 5311-E, 5311-X.

Service switches and distributing cabinets.

O-30 amperes, 125 and 250 volts, catalog Nos. 2000, 2002, 2003, 2011, 2012, 2013, 2051, 2052, 2053.

Listed April 12, 1915.

**SWITCHES, Knife.—The Trumbull Electric Manufacturing Company,** Plainville, Conn.

"Circle T" alternating-current motor-starting switches.

Consisting of standard double-throw knife switches, each with a spring-actuated fiber crossbar which removes switch blades from "starting" position when handle is released by operator.

With extensions for N. E. C. standard cartridge inclosed fuses.

Type "A," 250 volts.

30 amperes, catalog Nos. 1365, 1400, 1405, 1410. 60 amperes, catalog Nos. 1366, 1401, 1406, 1411. 100 amperes, catalog Nos. 1367, 1403, 1408, 1413.

500 volts.

30 amperes, catalog Nos. 1420, 1424, 1430. 60 amperes, catalog Nos. 1421, 1426, 1431. 100 amperes, catalog Nos. 1423, 1428, 1433.

Type "C," 250 volts.

30 amperes, catalog No. 1390. 60 amperes, catalog No. 1391. 100 amperes, catalog No. 1392.

Non-Fused.

Type "A," 250 volts.

30 amperes, catalog No. 1385. 60 amperes, catalog No. 1386. 100 amperes, catalog No. 1387.

Type "C," 250 volts.

30 amperes, catalog No. 1395. 60 amperes, catalog No. 1396. 100 amperes, catalog No. 1397.

Listed April 3, 1915.

# Current Electrical News

## ATLANTIC STATES.

HERMON, ME.—The Black Stream Electric Company, of Hermon, Me., proposes to construct a power station for water-power generation, erect transmission lines, and wire houses and streets for electric lights, about $15,000 to be expended in the near future.

NEW BRITAIN, CONN.—Mayor George A. Quigley has vetoed the municipal electric lighting project. The mayor disapproves of the action of the common council in adopting the resolution relating to the matter of municipal lighting because of the high cost of development and the lack of knowledge of the city as to the real facts connected with the operation of such a system.

ELIZABETH, N. J.—The Stuttgart Chemical Company, of Stuttgart, Germany, will erect a large plant for the manufacture of its product here. The company is capitalized at $230,000. John Fulton, Jr., is interested.

ELIZABETH, N. J.—The Leipzig Aniline Company, of Leipzig, Germany, capitalized at $200,000, is about to construct a plant here for the manufacture of aniline. John Fulton, Jr., is interested.

WASHINGTON, PA.—The Standard Tin-Plate Company will erect an addition to its plant at Canonsburg near here, for which an increase in capitalization of $500,000 has been provided. Louis Follet is general manager.

ROME, GA.—The city commissioners are considering the erection of a municipal lighting plant. The lighting committee is headed by J. P. Jones. An expert will probably be employed to make an estimate of the cost for installation and operation of a plant.

BATON ROUGE, LA. — Donald Stewart, manager of the Baton Rouge Electric Company, has announced that the company is planning for the immediate construction of a $200,000 power plant on Government Street, at the Louisiana Railway and Navigation intersection.

## NORTH CENTRAL STATES.

DAYTON, O.—Work on the addition to the plant of the Dayton Power & Light Co., involving the installation of power units of 10,000 horsepower, and costing about $150,000, is getting into shape, and indications are that it will be completed some time during the summer. L.

EAST YOUNGSTOWN, O.—A new lighting system for the village is under consideration by Mayor W. H. Cunningham and the other authorities, and the methods used in other towns are being looked into. L.

SHANDON, O. — The Shandon Lighting Company, recently incorporated with a capital stock of $5,000, by J. D. Schradin and others, is planning to construct a small electric power plant to furnish current for various purposes to local consumers. L.

YOUNGSTOWN, O. — The Block Light Company's plant, at Youngstown, O., has been sold by the sheriff, under court proceedings, for $145,000, after nearly a year in the hands of a receiver. The proceedings were started by the First National Bank of Youngstown to recover money due on notes, and another bank also brought suit, necessitating the receivership. The plant was purchased by Paul McElevey, and it is understood that its operation will not be interrupted.

ANDERSON, IND.—The city will make application to the State Public Service Commission for permission to borrow $50,000 for purchasing turbines, stokers, switchboards and other new equipment for the municipal electric light plant. Address City Attorney P. B. O'Neill.

HIGHLAND, WIS.—The village board has granted a franchise to the Mineral Point Public Service Company to install an electric lighting system in the village. The transmission line will be extended from Montfort.

MARIETTA, MINN.—May 20 has been decided on as the date when this village will determine by popular vote whether the village shall install an electric light plant.

MINNEAPOLIS, MINN.—J. F. Druar, consulting engineer, is preparing plans and specifications for a municipal water works system at Campbell, Minn. The system is to be operated electrically.

MINNEAPOLIS, MINN.—The Power and Engineering Company has been engaged by the Electric Light and Water Works Commission of Britt, Ia., to prepare plans and specifications for a proposed dam on Wolk River.

MINNEAPOLIS, MINN.—The city council of Mankato, Minn., has awarded the contract for the installation of a white way on Front Street to the Sterling Electric Company, of this city.

WILLMAR, MINN.—The installation of an electric lighting plant at Spicer under the direction of F. O. Hillman is insured. Contract for the work has been let to Peter Pearson of this city to furnish all the machinery and equipment and install the lights.

FESSENDEN, N. D.—The council has granted a franchise to B. W. Baldwin to erect an electric light plant at this place.

CLARK, S. D.—The trustees of the village of Garden City have granted a franchise to G. F. von Egeler to install an electric light and power plant sufficient to light and furnish power to the village and such private concerns as require it.

RAYMOND, S. D.—A modern electric light and power plant will be installed here. Address town clerk.

## WESTERN STATES.

ANACONDA, MONT.—City council has adopted a resolution for the installation of an ornamental lighting system on Main Street estimated to cost $6,000. Reported bids for the work and materials will be received by the city council, M. J. Kelly, clerk, in the near future. O.

MEDICINE BOW, WYO.—Articles of incorporation have been filed for the Medicine Bow Electric Company, whose object is to supply the town with power and light. Its capital is $10,000 and the incorporators are E. Anderson, S. H. Scofield, F. W. Shields, H. W. Richards.

SANTA FE, N. M.—The Rio Grande Light and Power Company, of Philadelphia, Pa., has made application to the State engineer of New Mexico for permission to construct a dam 100 feet high in White Rock canyon, between Cochiti and Buckman, and to use a part of the flow of the Rio Grande for the purpose of developing power for industrial purposes. It is planned by the company to build a large hydroelectric plant and to supply power to Albuquerque, Santa Fe, Las Vegas and to other towns and to irrigation pumping plants in the Estancia Valley. D.

BLACKTAIL, IDAHO—It is reported that Volney B. Williamson, of Spokane, Wash., principal owner of the Keystone Mining Company. here, recently announced that his company will spend between $100,000 and $150,000 in the construction of a concentrator and the installation of electric light plant, water power, mining machinery and telephone line, at the mines. Work will begin early this summer. O.

CALDWELL, IDAHO.—Caldwell, through its Commercial Club has taken the initiative in a move to get the cities and towns of this region to unite in arranging with Black Canyon irrigation district for municipal lighting plants. It is figured that one-third of the 15,000 horsepower to be generated by the proposed plant of the district will be for sale the year round and that two-thirds of the amount will be for sale during the winter months. The promotors declare that this current will be sold at a rate which will popularize its use for heating purposes over this territory as well as for lighting.

AMERICAN FORK, UTAH.—The Utah Power and Light Company has arranged to establish branch offices at both Lehi and Pleasant Grove. At each of these places, a stock of electrical supplies will be carried and the company's business will be attended to by its local representatives. The

company also intends to divide its force of linemen between the towns of Lehi, American Fork and Pleasant Grove, so that all operating work can be attended to with the greatest possible dispatch. The company's officials explain that these changes are in line with the improvements and adjustments that are being made from time to time to raise the company's service to the highest point of efficiency.

VERNAL, UTAH.—John Glenn, Marcellous Pope of this city, and R. W. Kroupa of Duchesne, have secured a franchise from the city council for an electric light and power plant in Duchesne and will commence work at once erecting a building. The cost is estimated at $10,000. They propose to give Duchesne a first-class electric plant. The plant will be erected in the center of the city. The river makes a horseshoe bend and the fall is so great that a canal cutting the point will give a fall of 13 feet, which will be utilized for power. Modern machinery has been ordered. By the terms of the franchise the entire plant must be in operation within 18 months. Light will be supplied to settlers in the surrounding country.

CUSHING, OKLA.—The Cushing Public Service Company, which was recently organized for the purpose of taking over the holdings of the Cushing Electric Light and Power Company, will make immediate improvements to the plant to cost about $20,000. H. Askin is manager. D.

MIAMI, ARIZ.—The City Council has adopted a resolution calling for a bond election to be held on June 15 for the purpose of passing on an issue of $130,000 for municipal improvements, including $30,000 for an electric plant.

NOGALES, ARIZ.—The Nogales Gas and Electric Light Company is arranging to extend its power facilities to a big scope of territory in this part of Arizona and Mexico. The company is erecting a new plant at a cost of $150,000. D.

PRESCOTT, ARIZ.—The Arizona Power Co. has started work on an addition to its plant at Fossil Creek, which will increase the capacity 2,000 horsepower. The plans call for the installation of nearly four miles of steel flume and about 3,000 feet of pressure pipe. It will also be necessary to construct a diversion dam and bore an intake tunnel 440 feet in length.

VANCOUVER, B. C.—The fire and police committees of the city council have been instructed by the city council to investigate the feasibility of installing a municipal light and power plant and to investigate three possible sites, one on Indian River, another on Checkamus River, Howe Sound, and the third on Seaton Lake, in the Lillooet District. The council has also instructed the city engineer to report on the development of the city's water power on Capilano and Seymour Creeks. O.

BAKER, ORE.—The city commissioners have blocked the movement for municipal light and power plant for a time, at least, by declaring illegal the petition filed by M. F. Newton, calling for a special election July 14, for an ordinance authorizing an appraisement of the work necessary in extending the present municipal plant, which lights public buildings and streets of this city only. O.

BARLOW, ORE.—E. P. Preble, here, has announced his intention of installing a small electric light and power plant on his ranch near this city, for the purpose of supplying his own property with light and power, and to sell the remainder to nearby ranches. O.

OREGON CITY, ORE. — E. P. Preble is preparing to install a small electric light and power plant on his place between Barlow and Aurora.

COLVILLE, WASH.—The Stevens County Power and Light Company, through its manager, H. R. Williams, has recently offered to the city the proposition of furnishing current for light and power for a term of 20 years, to be delivered at the city limits at approximately 2,200 volts pressure. The city has taken the proposition under advisement, as it is considering construction of a municipal lighting and power plant. O.

ELLENSBURG, WASH.—The city council rejected all bids submitted for the improvement of the light plant, the estimated cost of which is $60,000. Another call will be issued.

ENUMCLAW, WASH.—A franchise has been granted the Enumclaw Water and Light Company to install a system for the distribution of electricity for light, power and other purposes in this city.

PORT TOWNSEND, WASH.—Application has been made to the Commissioners of Jefferson County by James P. Holman for a franchise to construct power transmission lines in the county.

SEATTLE, WASH.—Superintendent of Lighting Ross has submitted a plan to Mayor Gill for the construction of an addition to the Lake Union municipal steam plant, increasing the light and power load of this auxiliary to 20,000 kilowatts. If the council approves the plan a bond issue of $425,000 will be voted upon to pay the cost.

SPOKANE, WASH.—The Little Spokane Light and Power Company, here, recently petitioned the Spokane County Commissioners for permission to extend its light and power lines from Deer Park to the Arcadia Orchards Company's tracts. The current to be used for pumping and other power requirements. O.

ALAMEDA, CAL.—The City Electric Commission is considering the extension of service to Bay Farm Island.

BLYTHE, CAL.—The Board of Supervisors of San Bernardino County has granted Floyd Brown a franchise to construct an electric transmission line through this town.

## PROPOSALS.

HARRISBURG, ORE.—Bids will be received by R. W. Davis, mayor, until May 28, for furnishing one 35 horsepower motor, 900 to 1,200 revolutions per minute; one 25 horsepower motor, 900 to 1,200 revolutions per minute, and one five horsepower motor, about 1,500 revolutions per minute. For additional information, address Mayor Davis. O.

ELECTRIC LIGHTING SYSTEMS.—Sealed proposals will be received by the Board of Education of Cincinnati, O., until May 24, for furnishing all materials and doing all work necessary to complete the installation of electric lighting systems in the College Hill School, located on Maple Avenue, College Hill, and the Mt. Airy School, located at Colerain Pike and Mt. Airy Road, in the city of Cincinnati, in accordance with plans on file at the office at 511 West Court Street. Address C. W. Handman, business manager.

## NEW PUBLICATIONS.

MAGNETIC EFFECT OF BORON.—Bulletin No. 77 of the Engineering Experiment Station of the University of Illinois is entitled "The Effect of Boron Upon the Magnetic and Other Properties of Electrolytic Iron Melted in Vacuo," by Trygve D. Yensen. It is the second of a series of bulletins dealing with the magnetic, electrical, mechanical, and metallurgical properties of iron melted in a vacuum furnace. Iron of an exceptionally good magnetic quality can be produced in such a furnace. Small percentages of added boron improve the iron slightly, while boron added in a sufficient amount to leave a measurable quantity combined with the iron has a decidedly detrimental effect upon the magnetic properties. The crystalline structure of the alloys is shown by means of numerous photographs. Copies of Bulletin No. 77 may be obtained gratis upon application to C. R. Richards, University of Illinois, Urbana, Ill.

MINERALS OF CANADA.—The Canadian Government Department of Mines, Ottawa, Canada, has issued a report of some 80 pages, entitled "Economic Minerals and Mining Industries of Canada." It gives a general survey of the prevalence of metallic and other minerals in Canada and of characteristic mining methods developed for their recovery. A large number of mining and smelting plants are shown in full-page illustrations.

## NEW INCORPORATIONS.

SYRACUSE, N. Y. — Hammerle Lighting Fixture Company, Incorporated. Electric and gas fixtures, electrical contracting, etc. Capital $10,000. The incorporators are Henrietta S. Hammerle, Charles H. Hammerle, and Clarence Hammerle.

NEW YORK, N. Y.—Electric Burglar Alarm Lock Company, Incorporated. Capital $15,000. Incorporators: William Deutscher, Charles Kurzweil, Benjamin Ammerman.

CHICAGO, ILL.—The Electrical Maintenance Company has been incorporated to do a general electrical construction business, etc. Capital $5,000. The incorporators are James Carins, Arthur L. Brown and Russell W. Patterson.

HILLIARD, O.—The Hilliard Light and Power Company has been incorporated with a capital of $10,000. The incorporators are LeRoy Bobyns, T. C. Latham, C. W. Fishinger, N. D. A. Scofield and J. W. Reason.

LOGAN, UTAH.—The Cache Valley Electric Company has been incorporated with a capital of $25,000 to engage in a general electric supply business. H. F. Laub, president.

ELIZABETHTOWN, KY.—The Greenup Electric Company has been incorporated with a capital of $10,000 and is authorized to issue bonds to the amount of $30,000. The company is now operating electric plants at Stithton, this county, and at Horse Cave, Munfordville and Bradenburg. The company is figuring upon establishing plants at Sonora and West Point this county.

## FINANCIAL NOTES.

The Shawinigan Water and Power Company is planning a new issue of capital stock, the proceeds to reimburse the treasury for additions made to property in the last year or so, and for additional working capital. The company now has $12,375,000 stock outstanding, and it is said that the new stock will be offered at par to stockholders, in the ratio of one share of the new issue to each three shares now held.

The Northern New York Power Corporation has sold to E. H. Rollins & Sons $900,000 six-per-cent bonds due serially from 1917 to 1940, and the bonds will be offered at a slight premium. Northern New York Power Corporation has developed 12,000 horsepower of hydroelectric energy on the Oswego River about 30 miles from Syracuse. The property has been leased to the Niagara, Lockport & Ontario Power Company, and the bonds are guaranteed by Columbia Mills, Incorporated.

New York bankers have purchased $1,150,000 Birmingham Railway, Light & Power Company two-year six-per-cent notes, dated May 1, 1915, due May 1, 1917, optional at 101 and interest to May 1, 1916, and 100.50 and interest thereafter. These notes are issued to provide a portion of the funds required to retire at maturity $1,500,000 notes due July 1, 1915. It is understood that the greater part of these notes have been privately placed and that the unsold balance will shortly be offered for public subscription at 99.50 and interest to yield 6.25 per cent. In addition to the $1,150,000 two-year six-per-cent notes, the Birmingham Railway, Light & Power Company has sold $640,000 refunding and extension six-per-cent bonds due May 1, 1957.

The Portland Railway, Light & Power Company has called a special meeting for May 14 at Portland, Oregon, for purpose of approving a readjustment of the capitalization of the company. Under the proposed plan the present outstanding capital stock will be made common stock and reduced from $25,000,000 to $20,000,000 and there will be authorized $5,000,000 six-per-cent cumulative first-preferred and $5,000,000 six-per-cent non-cumulative second-preferred. Of the new stocks $2,500,000 of each class will be retained in the treasury for future corporate purposes and $2,500,000 of each issue will be sold to stockholders to raise additional capital on the following terms: Each holder of 100 shares of present capital stock, or smaller holders in proportion, may turn in 20 shares of his holdings, accompanied by $25 for each share so turned in, and will receive 10 shares first preferred and 10 shares second preferred stock. With the completion of the plan, the Portland Railway, Light & Power Company will have a capitalization of $2,500,000 first-preferred, $2,500,000 second-preferred, and $20,000,000 common stock, the latter 75 per cent paid up, and the company will have raised $1,250,000 in cash.

### Dividends.

| | Term | Rate | Payable |
|---|---|---|---|
| Boston Elevated | Q | 1 % | May 15 |
| Detroit United Ry | Q | 1.5 % | June 1 |
| Mobile Electric pf | Q | 1.75% | May 15 |
| National Carbon pf | Q | 1.75% | May 15 |
| Penn. Cent. Lt. & Pr. pf. | — | 1 % | April 30 |
| Tampa Electric | Q | $2.50 | May 15 |
| Washington Ry. & El. com. | Q | 1.75% | June 1 |
| Washington Ry. & El. pf. | S-A | 2.5 % | June 1 |

### Reports of Earnings.

SOUTHERN CALIFORNIA EDISON.

| | 1915 | 1914 |
|---|---|---|
| March gross | $ 358,287 | $ 361,536 |
| Net earnings | 187,183 | 153,033 |
| Total income | 199,211 | 154,218 |
| Surplus after charges | 117,817 | 78,579 |
| Balance after depreciation | 82,317 | 78,579 |
| Three months gross | 1,128,814 | 1,146,647 |
| Net earnings | 606,633 | 525,400 |
| Total income | 622,753 | 527,018 |
| Surplus after charges | 377,436 | 304,679 |
| Balance after depreciation | 238,433 | 229,699 |

SOUTHWESTERN POWER & LIGHT.
(American Power & Light Subsidiary.)

| | 1915 | 1914 |
|---|---|---|
| March gross | $ 233,776 | $ 207,894 |
| Expenses and taxes | 121,220 | 121,806 |
| Net earnings | 112,556 | 86,088 |
| Twelve months gross | 2,868,575 | 2,403,079 |
| Expenses and taxes | 1,493,089 | 1,313,944 |
| Net earnings | 1,375,486 | 1,089,135 |

TEXAS POWER & LIGHT.

| | 1915 | 1914 |
|---|---|---|
| March gross | $ 130,571 | $ 116,012 |
| Net after taxes | 49,082 | 34,125 |
| Surplus after charges | 24,255 | 8,083 |
| Twelve months gross | 1,648,207 | 1,293,029 |
| Net after taxes | 614,059 | 460,121 |
| Surplus after charges | 382,545 | 208,462 |
| Balance after preferred dividends | 204,603 | 98,212 |

MASSACHUSETTS ELECTRIC.

The report of the Massachusetts Electric Company for the quarter ended March 31, 1915, compares as follows:

| | 1915 | 1914 |
|---|---|---|
| Gross | $2,055,180 | $2,029,027 |
| Deficit after charges | 1,139 | *105,449 |
| Nine months gross | 7,245,156 | 7,196,463 |
| Surplus after charges | 707,653 | 895,145 |

*Surplus.

MONTREAL LIGHT, HEAT & POWER.

| | 1915 | 1914 |
|---|---|---|
| March gross | $ 561,165 | $ 540,996 |
| Net after taxes | 299,413 | 281,886 |
| Surplus after charges | 261,340 | 248,179 |
| Eleven months gross | 6,095,642 | 5,816,363 |
| Net after taxes | 3,404,030 | 3,211,675 |
| Surplus after charges | 3,004,901 | 2,821,508 |

AMERICAN LIGHT & TRACTION.
For year ended March 31, 1915:

| | 1915 | 1914 |
|---|---|---|
| Earnings on stock owned | $3,813,381 | $3,712,368 |
| Other earnings | 742,783 | 710,398 |
| Total gross | 4,556,164 | 4,422,767 |
| Expenses | 158,221 | 130,882 |
| Balance for dividends | 4,397,943 | 4,291,884 |
| Previous surplus | 9,577,508 | 8,888,790 |
| Total surplus | 13,975,450 | 13,180,675 |
| Preferred dividends | 854,172 | 854,172 |
| Cash dividend, common | 1,515,580 | 1,374,497 |
| Stock dividend, common | 1,515,580 | 1,374,497 |
| Total dividends | 3,885,332 | 3,603,167 |
| Surplus after dividends | 10,090,118 | 9,577,508 |

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

| | May 3 | Apr. 26 |
|---|---|---|
| American Tel. & Tel. (New York) | 122⅝ | 121¼ |
| Commonwealth Edison (Chicago) | 135½ | 136 |
| Edison Electric Illuminating (Boston) | — | 245 |
| Electric Storage Battery, common (Philadelphia) | 53½ | 52½ |
| Electric Storage Battery, preferred (Philadelphia) | 53½ | 52½ |
| General Electric (New York) | 160 | 152 |
| Kings County Electric (New York) | 119 | 119 |
| Massachusetts Electdic, common (Boston) | — | 7 |
| Massachusetts Electric, preferred stamped (Boston) | — | 42½ |
| National Carbon, common (Chicago) | — | — |
| National Carbon, preferred (Chicago) | — | 119½ |
| New England Telephone (Boston) | 128 | 128 |
| Philadelphia Electric (Philadelphia) | 24⅝ | 24⅝ |
| Postal Telegraph and Cables, common (New York) | 80 | 80 |
| Postal Telegraph and Cables, preferred (New York) | 67½ | 67½ |
| Western Union (New York) | 68½ | 68¼ |
| Westinghouse, common (New York) | 103½ | 86⅝ |
| Westinghouse, preferred (New York) | 126 | 120 |

## PERSONAL MENTION.

MR. NEILSON EDWARDS has resigned his position with the Butler-Edwards Electric Company, of Easton, Pa., to become vice-president of the Nitrogenous Chemical Company, of Philadelphia.

MR. H. S. COLLETTE, secretary of J. G. White & Company, Inc., and J. G. White Engineering Corporation, has resigned from these companies, and expects to reside permanently in California.

PROF. VLADIMIR KARAPETOFF, of the electrical engineering department at Cornell University, has been appointed by President Moore to act on the International Jury of Awards in the Electrical Division at the Panama-Pacific International Exposition.

MR. THOMAS A. EDISON has been voted the American who has done the most to benefit mankind, and is to receive the Civic Forum Medal of Honor for distinguished public service. The medal, which was established to give recognition upon the part of the rank and file of the American people to that one of their countrymen who in ways of peace performed some signal public service, was first awarded last year, Colonel George W. Goethals being the recipient.

GEN. GEORGE H. HARRIES, president of the Louisville Gas and Electric Company since its organization, and brigadier general of the National Guard of the District of Columbia, has resigned his commission in the latter organization. The reason assigned is that General Harries' enforced absence from Washington makes it impossible for him to give the required attention to the post. Much of his time is now spent in Louisville, Omaha and Chicago.

MR. O. L. REMINGTON, general manager of the firm of William McLean & Company, merchants, engineers, manufacturers and importers, with head offices in Melbourne, Australia, has arrived in the United States with one of the company's engineers, Mr. H. P. McColl, and is investigating methods, machinery and new developments in the electrical industry. Mr. McColl is now making his headquarters at the Hotel La Salle, Chicago, where he will be joined in the near future by Mr. Remington.

LIEUT. BRYSON R. BRUCE, a graduate of Annapolis, who last year completed a post-graduate course in the Graduate Engineering School of Columbia University, has been appointed chief engineer in charge of the collier *Jupiter*, the first electrically propelled ship used by the government. The success of recent tests on the *Jupiter* has induced the government to install similar electrical propulsion apparatus in the new battleship *California*, contracts for which were recently executed. Lieutenant Bruce will have charge of future tests.

PROF. JOHN ZELENY, who for several years has been head of the physics department of the engineering college of the University of Minnesota, has resigned, to accept a similar position in the Sheffield Scientific School of Yale University. Professor Zeleny has had a long connection with the teaching staff of the Minnesota institution in various capacities. He has been interested in the field of electricity, and has made

a special study of point discharges. The results of his researches have been given to the public in the form of papers read at meetings of the American Physical Society. Professor Zelany is at present in Manchester, England, engaged in special research work. He will assume his duties at Yale in September.

MR. ROBERT L. JAYNES, Tenth Jupiter of the Jovian Order, is a candidate for election to the House of Delegates of Spotsylvania County and of Fredericksburg, Va. "Bob" Jaynes is well known to the electrical industry as one of the most progressive and active of the business spirits of the industrial city of Pittsburgh. It is not so well known that he is the owner of a large stock farm at Massaponax, Va., and is one of the very successful breeders of Aberdeen-Angus cattle. When Jaynes was elected Jupiter of the Jovian Order at Denver, Colo., in October, 1911, there were about 4,000 members, a deficit in the treasury, and a grand opportunity for some mighty big upbuilding. At the close of the tenth administration the membership had increased to something over 8,000, a substantial appropriation had been apportioned to the Past-Jupiters' Endowment Fund, and a considerable amount of money had been expended for the rehabilitation of available and the purchase of new paraphernalia; there had been a liberal expenditure for improving office methods, the deficit had been wiped out, and a handsome balance reposed in the treasury of the Order. Jaynes has always had the esteem and confidence of a wide circle of friends and acquaintances in the electrical business. It is only reasonable to assume that if he adapts himself with the same courage and ability to a representation of his home constituency as he has to those things that we in the business are familiar with, his community will be served in extraordinary fashion. "Bob" goes up for the action of the Democratic primaries on August 3. He will have the good wishes of the industry with him.

MR. T. W. SIMPSON, for the past year in charge of the specialty department of the Federal Sign System (Electric) at Chicago, has been appointed western district manager with headquarters at San Francisco, Cal. The territory under Mr. Simpson's jurisdiction comprises Washington, Oregon, California, Arizona, Nevada, Utah and Idaho, and covers the operations of a factory at San Francisco, and a sales and jobbing business in electric specialties and signs. Mr. Simpson was formerly superintendent of the Chicago factory of the Hotpoint Electric Heating Company. He is a member of the American Institute of Electrical Engineers, the American Society for Mechanical Engineers, the

T. W. Simpson.

American Society for Testing Materials, and the Efficiency Society. Mr. Simpson is a graduate of Armour Institute of Technologv.

## OBITUARY.

MR. WILLIAM H. BANCROFT, until February of this year, president of the Utah Light and Railway Company, died on April 23, death resulting from a stroke of apoplexy. About a year ago Mr. Bancroft retired as vice-president and general manager of the Oregon Short Line Railroad Company, a position which he had held for 23 years, he having been selected by the late Mr. E. H. Harriman for this place when Mr. Harriman acquired control of the Oregon Short Line Railroad. When Mr. Harriman acquired control of the Utah Light and Railway Company about eight years ago, Mr. Bancroft was assigned to the responsible position as president of the company and upon him devolved the important part of rehabilitating the street railway and lighting and power system of Salt Lake City which was then in a very badly depreciated condition. He attacked the problem with his usual foresight and energy and made of the property one of the finest in the West, put it on a paying basis and amply demonstrated Mr. Harriman's judgment in making the purchase.

## DATES AHEAD.

Society for Electrical Development. Annual meeting, New York City, May 11. General manager, J. M. Wakeman, 29 West Thirty-ninth Street, New York, N. Y.

National Fire Protection Association. Annual convention, New York City, May 11-13. Secretary, F. H. Wentworth, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual meeting, Little Rock, May 11-13. Secretary, W. J. Tharp, Little Rock, Ark.

Arkansas Association of Electrical Contractors. Annual meeting, Little Rock, May 12-13. Secretary, J. C. Dice, Little Rock, Ark.

Ohio Electrical Contractors' Association. Annual convention, Hotel Havlin, Cincinnati, O., May 12-13. Secretary, F. M. Grant, Cleveland, O.

Gas, Electric and Street Railway Association of Oklahoma. Fourth annual convention, Oklahoma City, May 12-14. Secretary, H. V. Bozell, Norman, Okla.

Southwestern Electrical and Gas Association. Eleventh annual convention, Galveston, Tex., May 19-22. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Missouri Public Utilities Association. Annual convention, Steamer *Quincy*, May 27-30. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

National District Heating Association. Annual convention, Hotel Sherman, Chicago, Ill., June 1-3. Secretary, D. L. Gaskill, Greenville, O.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Michigan Section, National Electric Light Association. Annual convention cruise, Steamer *Rochester,* June 26 to 30. Secretary, Herbert Silvester, 18 Washington Avenue, Detroit, Mich.

National Electrical Contractors' Association of the United States. Fifteenth annual convention, San Francisco, Cal., July 21-24. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

# With the Electrical Manufacturers

**Wagner Electric Manufacturing Company,** St. Louis, Mo., announces the change in address of its Minneapolis (Minn.) office from 1040 Security Bank Building to 307 Security Building.

**General Lead Batteries Company,** Newark, N. J., announces the removal of its Chicago office from 2332 Michigan Avenue to 219 East Twenty-fourth Street. This office carries a large stock of GLB vehicle, starting, and sparking and lighting batteries, and also repair parts for the same, as well as for all other standard makes of batteries.

**International Oxygen Company,** 115 Broadway, New York City, has recently secured a contract from the Tokio Electric Company, Tokio, Japan, for the installation of its cells for the production of oxygen and hydrogen gases. This order was secured through H. L. Barnitz, sales agent of the company, who has recently made several other foreign installations of these cells.

**Delta-Star Electric Company,** Chicago, Ill., is distributing a unique box model of a standard steel-tower outdoor high-tension substation. The model is of the folding type, and has

been found very useful to constructing engineers called upon to erect outdoor substations. One of these models can be secured upon request by those interested.

**American Electrical Works,** Philipsdale, R. I., has ready for distribution a new price list of its bare and insulated copper and iron wires and cables. Among the varieties of conductors listed are plain and tinned bare copper wires and cables, weatherproof wires and cables, stranded cables, galvanized-iron wire, several types of magnet wire, office and annunciator wire, various kinds of cords, etc.

**Sangamo Electric Company,** Springfield, Ill., has published some new leaflets on its new model Sangamo type H induction watt-hour meters, type D-5 direct-current watt-hour meters for two-wire and three-wire circuits, and type M-S ampere-hour meters for use with storage batteries. These leaflets point out some of the most distinctive features of these instruments and are attractively illustrated.

**The Thompson Electric Company,** 5606 Euclid Avenue, Cleveland, O., has issued a leaflet entitled "Getting the Light You Have Paid For." It shows the advantage of using Thompson safety cutout hangers for Cooper Hewitt mercury-vapor quartz lamps. These hangers permit lowering the lamps for cleaning and inspection with perfect safety, the trimmer remaining on the ground while doing so.

**The Jefferson Glass Company,** Follansbee, W. Va., has opened a branch office at San Francisco, Cal. The office and sample rooms are in the Rialto Building, and in charge of Edwin B. Pike, who has been appointed San Francisco sales manager. He will handle all of the Jefferson glass products, including the famous Moonstone illuminating glassware and the Chippendale glass tableware.

**Kerr Turbine Company,** Wellsville, N. Y., is distributing bulletin No. 53 on Economy exhaust-steam turbines, which describes and illustrates typical installations and explains the conditions under which exhaust turbines can be made to produce large increase in power output practically without other expense than the cost of the turbine installation. A copy of this bulletin will be mailed upon request to the company.

**Bodine Electric Company,** Chicago, Ill., has removed its factory, offices and salesrooms from the former location on West Randolph Street to the new Bodine Building at the corner of Oakley Boulevard and Ohio Street. This removal provides the company with much more commodious quarters and increased facilities for the manufacture of small direct-current and alternating-current motors and other electrical apparatus.

**Central Electric Company,** 326 South Fifth Avenue, Chicago, Ill., has recently published catalog No. 36 on automobile supplies. Included in this is a very large variety of electrical, mechanical and other equipment needed by the owner of an automobile and by garage and repair men. A large assortment of automobile accessories, tools and other materials is listed. Although the catalog contains 256 pages, it is gotten up in handy form by printing on thin paper. Net price list No. 38 applies to this catalog.

**The Butler-Edwards Electric Company,** of Easton, Pa., which purchased the business and plant of the Edwards & Smith Company, of the same place, and also the business and equipment of the Butler Electric Company, of Chicago, last year, has been receiving orders which tend to show business improvement. An electric fan company of Newark, O., has given the company an order for $12,000 worth of goods and a dental sales company, of Madison, Wis., has placed an order of $15,000 worth of dental engines. W. E. Harvey, sales manager, states that conditions in this line of business have improved more than 100 per cent since December.

**Westinghouse Lamp Company,** 1261 Broadway, New York City, has ready for distribution the first of a series of monthly handbooks intended for the special information of lamp salesmen. These booklets will be strictly educational and are intended to increase the fund of knowledge on lamps and lighting possessed by the salesmen so that he may be informed on the great variety of questions and problems put up to him and have more selling arguments available. No. 1 of the series deals chiefly with the historical development of artificial lighting, touching on early artificial light, candles and oil lamps, gas, acetylene, arc lamps of various types, mercury and other vapor lamps and tubes, Nernst glowers, early incandescent lamps, metallized filaments, tantalum, vacuum tungsten and gas-filled tungsten lamps. The style is not difficult to follow and the book should prove of great value to lamp and lighting salesmen.

**Duncan Electric Manufacturing Company,** Lafayette, Ind., has again increased its manufacturing space by taking possession of over 51,000 square feet of floor space in the building adjoining its works. This building was formerly occupied by the Sterling Telephone Company; by securing this additional space the company now has about 100,000 square feet of floor space devoted to manufacturing purposes. The newly occupied buildings are being remodeled so as to bring them into thoroughly up-to-date condition; new large windows are being installed to secure an abundance of light; a sprinkler system is being added to conform to the rest of the Duncan works; to provide for additional power and steam heating a new power plant is being built which will contain a 500-horsepower steam turbine. Part of the transformer factory is being moved into the new quarters, which will also house the testing, assembling and shipping departments. This expansion in the Duncan manufacturing facilities was urgently needed on account of the growth of the business and also to accommodate several new lines of manufacture that the company hopes to add this summer.

**Westinghouse Electric & Manufacturing Company,** East Pittsburgh, Pa., has issued a pamphlet entitled "Radiator Type Transformers For the New Haven System." This is a reprint of an article describing this newly developed type of transformer which has recently been put into service on the New York, New Haven & Hartford Railroad. The transformer installation was called for by the increase in load on the Cos Cob power station of this system. For reasons of economy additional energy is being supplied the New Haven system by the United Electric Light & Power Company, New York City, and this transformer is used to transform the voltage of this supply to that suitable for the railway. The banks of the step-up transformers in the 201st Street station are each made up of a large unit, rated at 5,000 kilovolt-amperes, connected in T with a similar unit of 1,000 kilovolt-amperes rating, connected as a "teaser." This bank receives three-phase energy at 6,600 volts. The secondary winding steps up the voltage to 24,600, while the "teaser" steps it to 12,300. This gives an unsymmetrical three-phase transmission voltage, having the higher potential across the principal phase and 17,400 volts across the other two phases.

# Record of Electrical Patents.

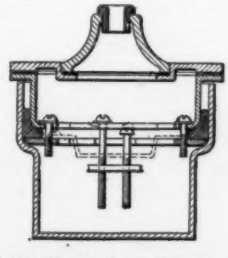
## Issued by the United States Patent Office, April 27, 1915.

**1,136,929. Universal Floor Box.** W. A. Bonnell, Brooklyn, N. Y., assignor to Fountain Electrical Floor Box Corporation. Has two adjustable body parts with clamping ring and gasket between them. (See cut.)

**1,136,942. Laminated Core for Electrical Apparatus.** E. B. Cutten, assignor of three-fourths to United States Horse Shoe Co., Erie, Pa. Sheets for machine core are provided with narrow slits in direction of lines of force, the slits in adjacent sheets being staggered.

**1,136,943. Dynamo-Electric Machine.** E. B. Cutten, assignor of three-fourths to United States Horse Shoe Co. Amplification of above.

**1,136,961. Spark Plug.** J. P. Inman and R. E. Estes, Midland, Tex. Includes special insulator.



No. 1,136,929.—Universal Floor Box.

**1,136,995. Electric Water Fountain.** O. F. Battaglia, New York, N. Y. Motor-driven centrifugal pump and electric lamp in center of basin.

**1,136,996. Spark Plug.** C. W. Beck, assignor to Beck-Frost Corporation, Detroit, Mich. Arranged to prevent deposit of carbon.

**1,137,019. Voltage Regulator.** A. Pollak, Paris, France. For variable-speed dynamo with storage-battery auxiliary.

**1,137,027. Electricity Meter.** G. A. Scheeffer, assignor to Roller-Smith Co., New York, N. Y. Has two separate armature windings on independent cores.

**1,137,030. Dry Cell.** E. C. Smith, assignor

to National Carbon Co., Cleveland, O. Has rigid disk at top bearing on the folded fiber lining holding the mix.

**1,137,044. Keyboard for Printing-Telegraph Apparatus.** W. Zabel, assignor to Union Switch & Signal Co., Swissvale, Pa. Continuously rotating shaft and sunflower combination.

**1,137,046. Sectioning Means for Electric Stations Provided with Accumulators.** E. Brandenburg, Brussels, Belgium. Interconnected circuit-breaker arrangement.

**1,137,050. Electrical Cooking Device.** F. E. Carlson, assignor to Landers, Frary & Clark, New Britain, Conn. Special heater construction for oven.

**1,137,060. Sound Transmission and Recording.** O. E. Kellum, Los Angeles, Cal. Motion-picture camera and phonograph recorder electrically controlled to act in synchronism.

**1,137,070. Signaling Device for Vehicles.** M. T. Miller, Los Angeles, Cal. A number of electric lamps with reflectors in a box.

**1,137,084. Mechanism for Controlling Railroad Signals.** A. H. Renshaw, assignor to Federal Signal Co., Albany, N. Y. Motor-operated semaphore.

**1,137,089. Railway Signal and Control Apparatus.** C. F. Rumold, Berea, Ky. Electromechanical system.

**1,137,091. Lamp for Barbers' Chairs.** A. Sclafani, New York, N. Y. Adjustable electric lamp and reflector.

**1,137,116. Automatic Vehicle Tire Signal.** J. H. Brown, Midvale, Utah. Electric alarm signal controlled by deflation of tire.

**1,137,121. Electric Regulation.** J. L. Creveling, assignor to Safety Car Heating & Lighting Co. Generator-voltage regulator for car-lighting system.

**1,137,146. Printing-Telegraph Apparatus.** C. L. Krum, assignor to Morkrum Co., Chicago, Ill. Includes switch-controlling finger keys operated by a common actuator.

**1,137,150 to 1,137,152. Composite Electric System.** A. D. T. Libby, assignor to Garford Mfg. Co., Elyria, O. Three patents on combined fire-alarm and telephone, and police-alarm and telephone systems.

**1,137,174. Electrical Distribution System.** P. H. Thomas, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Impedances in leads of mercury-arc converter to maintain arc in operation.

**1,137,177. Locking Device for Electric Lamps.** H. T. Worrall, Chelmsford, England. Locking socket for incandescent lamp with separable cap sections.

**1,137,186. Telephone Receiver.** J. J. Comer, assignor to Automatic Enunciator Co., Chicago, Ill. Has adjustable air gap between magnet and armature.

**1,137,187. Resonator.** J. J. Comer, assignor to Automatic Enunciator Co. Horn construction for loud-speaking telephone receiver.

**1,137,188. Differential Microphone Repeater.** J. J. Comer, assignor to Automatic Enunciator Co. Special stem construction.

**1,137,189. Transmitting Apparatus.** J. J. Comer, assignor to Automatic Enunciator Co. Multiple transmitter for loud-speaking telephone.

**1,137,193. Means of Combined Telephonic and Telegraphic Transmission.** P. B. Delany, South Orange, N. J. Includes microphone transmitter, a buzzer and means for transmitting dot-and-dash impulses generated in the buzzer.

**1,137,200. Common-Battery Automatic Telephone System.** W. L. Campbell, assignor to First Trust & Savings Bank, Chicago, Ill. Automatic trunking system.

**1,137,204. Lamp.** A. B. Gates, Peterborough, Ont., Canada. Lamp and reflector mounted directly on terminal end of dry cell.

**1,137,221. Headlight Attachment.** W. F. Lennon, Willimantic, Conn. Lower part of lamp bulb is covered by light deflector.

**1,137,222. Torpedo and Other Submarine Apparatus.** K. O. Leon, assignor to Leon Steering Device Co., Brooklyn, N. Y. Steering electrically controlled through receivers sensitive to submarine sounds.

**1,137,223. Machine Telephone Switching System.** F. R. McBerty and L. Polinkowsky assignors to Western Electric Co. Automatic controling and registering system.

**1,137,226. Electrolyte for Primary Batteries.** A. P. Manchester, Providence, R. I. Sodium hydrate and starch.

**1,137,231. Machine Telephone Switching System.** L. Polinkowsky, assignor to Western Electric Co. Non-decimal automatic system.

**1,137,235. Telephone Receiver.** H. H. Schneider, Seattle, Wash. Relates to magnet construction.

**1,137,236. Locomotive with Cable-Reeling Mechanism.** F. L. Sessions, assignor to Jeffrey Mfg. Co. Electric motor drives either the axles or the haulage reel.

**1,137,239. Combined Electric and Pneumatic Horn.** W. Sparks, assignor to Sparks-Withington Co., Jackson, Mich. Diaphragm operated either electromagnetically or by bulb.

**1,137,271. Trolley Harp Carrier.** A. C. Miner, Missoula, Mont. Arranged to swing vertically and laterally.

**1,137,275. Filament for Audions.** A. McL. Nicolson, assignor to Western Electric Co. Consists of a twisted platinum filament with an oxide coating.

**1,137,295. Electrical Connector or Socket.** J. C. Stearns, Worcester, Mass. Includes plug with radial pin and metallic armor.

**1,137,308. System of Ship Propulsion.** W. L. R. Emmet, assignor to General Electric Co. Steam turbine with adjustable-speed governor drives alternator which supplies current to induction motors operating propellers.

**1,137,309. Oil Switch.** L. Fleischmann and A. Elfes, assignors to General Electric Co. Has woven-wire screen just below oil surface.

**1,137,315. System for the Transmission of Intelligence.** R. A. Heising, assignor to Western Electric Co. Telephone repeater with two audions having a common output circuit.

**1,137,322. Focusing Device for Electric Lamps.** H. H. Holland and J. C. Stearns, Worcester, Mass.; said Holland assignor to said Stearns. Sleeve about lamp base has helical slot engaging a bushing.

**1,137,337. Mining Machine and Truck.** N. D. Levin, assignor to Jeffrey Mfg. Co. Motor drives axles and also cable reel.

**1,137,340. Circuit Interrupter.** C. Lichtenberg, assignor to General Electric Co. Oil circuit-breaker.

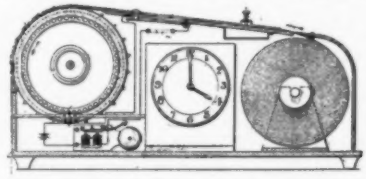
**1,137,352. Rheostat.** G. B. Reisbach, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Theater dimmer with individual levers for different sections and a master lever for all.

**1,137,360. Telephone System.** C. Smith, assignor to Frederick C. Stevens, Attica, N. Y. Semi-automatic system.

**1,137,372. Telephone Exchange System.** J. L. Wright, assignor to F. C. Stevens. Semi-automatic switching.

**1,137,379. Show Case Light.** A. W. Beuttell, Streatham, London, England. Molding with sockets fits in the corner of the case.

**1,137,384. System for the Transmission of Intelligence.** E. H. Colpitts, assignor to Western Electric Co. Audion telephone repeater.



No. 1,136,427.—Appointment Announcer.

**1,137,399. Multicoin Collector and Rate-Indicator for Automatic Telephone Systems.** C. L. Goodrum, assignor to Western Electric Co. Calling connection is not completed until proper coin is deposited.

**1,137,401. Electromechanical Controlling Means for Fluid Supplies.** W. O. Haymond, Muncie, Ind. Motor-operated valve.

**1,137,413. Metering Panel Board.** A. C. McWilliams, Chicago, Ill. Has a main-circuit section surrounded by the meters and above it a cutout section with interchangeable arrangement of branch circuits.

**1,137,427. Appointment Announcer.** S. R. Schaff, Louisville, Ky. A perforated strip and clock control an electric alarm. (See cut.)

**1,137,464. Lamp.** T. J. Corcoran, Cincinnati, O. Electric headlight for automobile.

**1,137,474 and 1,137,475. Selective Signaling Apparatus.** E. R. Gill, Yonkers, N. Y., assignor to Hall Switch & Signal Co. Selector for train dispatching governed step by step by long and short electrical code impulses.

**1,137,478. Device for Detecting Mechanical Vibration.** F. Gottschalk, Stirling, N. J. Transmitter cell responds to vibration.

**1,137,479. Resistance Cell for Transmitters.** F. Gottschalk. Details of construction.

**1,137,492. Magnetic Separator.** A. H. Kidney, Orange, N. J. Poles provided with special shield.

**1,137,510. Dynamo-Electric Machine.** E. Mattman, assignor to Allis-Chalmers Mfg. Co. Fan blades on the rotor between the end turns and collector rings draw air over the latter and force it among the end turns.

**1,137,513. Electric Heater.** W. A. Miller, New York, N. Y. Globular water vessel with heating coil inserted into neck at bottom.

**1,137,519. Automobile Safety Device.** S. Newburger, New York, N. Y. Auxiliary control for ignition circuit.

**1,137,544. Tone Producing Means.** M. L. Severy, Arlington Heights, and G. B. Sinclair, Medford, Mass. A number of motor-driven generators supply current to electromagnetic vibrators.

**1,137,557. X-Ray Apparatus.** H. F. Waite, New York, N. Y. Supplied from alternating-current source through adjustable interrupter.

**1,137,559. Metallurgical Furnace.** U. Wedge, Ardmore, Pa. Resistance furnace.

**1,137,568. Lamp Carrier.** T. Birath, assignor to Manhattan Electrical Supply Co., Jersey City, N. J. Lamp, reflector, socket, switch and handle are mounted directly on common-dry-cell terminals.

**1,137,593. System of Ship Propulsion.** W. L. R. Emmet, assignor to General Electric Co. Modification of No. 1,137,308 with means to bring turbine speed to normal when load is thrown off.

**1,137,609. Initial Sparker for Gas-Engine Magnetos.** L. Haggblom, Los Angeles, Cal. Magneto is retarded and suddenly released to give strong spark in starting.

**1,137,610. Circuit Controller.** C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. Periodic contact-maker for maximum-demand auxiliary of integrating meter.

**1,137,614. Amplifier for Telephones.** R. D. Hatch, Memphis, Tenn. Horn secured to receiver.

**1,137,620. Tractor System for Motor Vehicles.** A. H. Hoadley, Providence, R. I. Gas-electric tractor; current to both motors is cut off when load on them is unbalanced to prevent steering trouble.

**1,137,628. Twin Signaling Apparatus.** J. A. Johnson, Stockville, Neb., assignor of one-half to E. D. Brown. Track-circuit-controlled semaphore.

**1,137,634. Electrical Plug and Receptacle.** W. R. Kelting, New York, N. Y. Has a separate plug and receptacle for each pole.

**1,137,660. Automatic Electrically Actuated Train-Controlling System.** E. L. Orcutt; F. A. Maddox, Medford, Mass., and E. N. Hutchins, Somerville, Mass., executors of said Orcutt, deceased. Specially arranged and controlled track circuits.

**1,137,674. Rain Indicator.** C. E. Smith, Brownsburg, Ind. Cup below funnel swings to close alarm circuit.

**1,137,677. Setting Device.** W. F. Straub, assignor to Electric Time Recorder Co., Chicago, Ill. Superposed on regular impulses sent out by master clock to secondary clocks are synchronous setting impulses.

**1,137,705. Automatic Block Signaling System for Electric Railways.** S. M. Day, Rochester, N. Y., assignor to General Railway Signal Co. Means to guard against excess potentials.

**1,137,713. Timer.** F. C. Hersee and L. W. Lombard, assignors to Motor Specialties Co., Waltham, Mass. For ignition circuit.

**1,137,714. Solid Rectifier for Feeble Electric Currents.** G. W. Pickard, Amesbury, Mass. Special holder for wireless crystal detector.

**1,137,717. Call Box.** C. S. Rhoads, Jr., assignor to Hall Switch & Signal Co. For electric signaling system.

**Reissue 13,906. Means for Maintaining Vapor Converters in Operation.** P. H. Thomas, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Original No. 964,336, dated July 12, 1910. Auxiliary electrodes connected to intermediate points on transformer secondary.

### Patents Expired.

The following United States electrical patents expired on May 3, 1915:

603,263. Process of and Apparatus for Electrolytic Tanning. E. Davis, Philadelphia, Pa., and H. R. Mustard, Smyrna, Del.

603,270. Automatic Electric Fire-Alarm. W. E. Frost, Lewiston, Me.

603,283. Electric Arc Lamp. T. H. Pettengill, Amsterdam, N. Y.

603,286. Electroplating Apparatus. L. Potthoff, Flushing, N. Y.

603,334. Electrical Attachment for Gas Lights. F. L. Kellner and G. S. Barrows, Philadelphia, Pa.

603,369. Electric Signal System. L. C. Werner, Broad Brook, Conn.

603,383. Electric Arc Lamp. A. W. Knutson, Galesburg, Ill.

603,390. Electric Signal System. L. C. Werner, Broad Brook, Conn.

603,450. Electric Program Clock. J. O. Lyman, Waterbury, Conn.

603,515. Electrical Apparatus. W. Stanley, Pittsfield, Mass.

603,524. Electric Dental-Engine Controler. J. J. Coachman, Rio Janeiro, Brazil.

603,594. Time-Limit Cutout. H. H. Cutler, Chicago, Ill.

603,606. Electric Conveying System. A. S. Krotz, Springfield, O.